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Comparative Costs of American and British Marine Engine Work.

It has been the generally held opinion among those qualified to judge that British shipbuilding establishments and their methods compare more favorably with American establishments of the kind than those devoted to any other of the metal-working industries. Until quite recently, in fact, it has seemed that development and improvement in shipbuilding plants in America had not by any means kept pace with what is to be seen in other lines, such for instance as tool building, or locomotive and stationary engine building. Few, however, were prepared to accept such figures of relative costs in the two countries as were given by George W. Dickie, of the Union Iron Works, in his paper recently read before the Society of Naval Architects and Marine Engineers, in which he said that on the hull of "an average ocean-going freight and passenger steamer" labor costs in American yards are 25 per cent. greater than in British and for the machinery 50 per cent. greater.

In another part of the paper he states that machinists and boiler makers receive about 50 per cent. higher wages here than in Britain, from which we must conclude that the British workman does about the same amount of work in a given time as is done by American workmen in marine engine and boiler shops. If this is so, then we believe that these two branches of engineering work are about the only ones of which the same can be said. British employers and workmen are generally agreed that more work is done per hour per man here than in British shops and none are more emphatic on this point than English or Scotch machinists who come over here and work in American shops. If the marine engine shops are an exception in this respect, it will be of some importance perhaps to find out whether it is because British marine shops are so much better than other British shops or because American marine shops are so much worse than other American shops, and we believe that evidence can be found for both hypotheses, particularly the last-named one.

It is worth noting, however, that Mr. Dickie's statements did not go unchallenged in the meeting and men presumably equally familiar with the industries concerned were apparently free to state their conviction that no such differences of cost existed as were mentioned by Mr. Dickie, whose to-be-regretted absence from the meeting prevented him from replying.

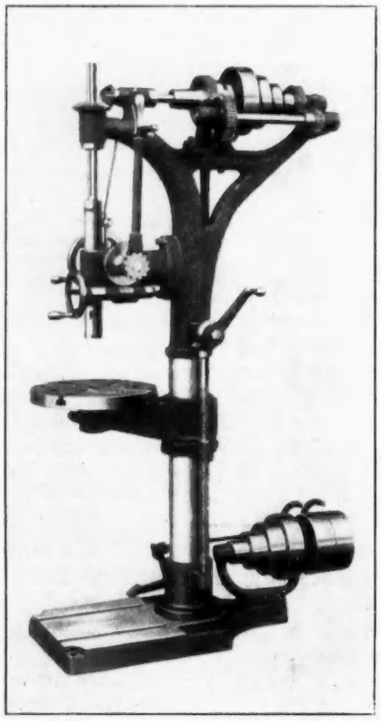
Referring again to the remarkable journals, "The Southern Review of Commerce," of Louisville, and "The Southern Trade Record," of Cincinnati, we note that the latter paper, at least, has devised a scheme by which it hopes to make another series of special articles. That is to say, after it has published one article on a given thing as "the best of its kind in the world" and proven to be so by a very thorough and marvelously extensive investigation conducted by the aforesaid journal's remarkable agglomeration of experts and detectives, they get up another article pertaining to the same thing, and which article is entitled "We Were Right," and in it they say that, notwithstanding the publication of the first article, they have received inquiries about the same thing from others of their readers, and consequently they from their army of investigators, experts and detectives have selected another and entirely distinct corps of able investigators, who have again made an investigation of the same subject, this second corps of investigators being, however, kept in the dark regarding the fact that any previous investigation had been made. It turns out, of course, that this second corps of investigators arrives at the same result that the first corps of investigators arrived at, and consequently the able editor is ready to publish an article setting forth the fact that two independent investigations have proven that the aforesaid article, whatever it may be, is the best of its kind in the world. He proposes to publish this second article, as usual, of course, extending an invitation to the person who manufactures the goods to buy copies of the paper at a price about fourteen times what they are worth—if, in fact, it is allowable to state a ratio between selling price and value where the real value of a thing is absolutely nothing whatever. It is simply an effort to swindle the same person the second time.

The managing director of a manufacturing company in Braintree, England, writes to the "Engineer" saying that he has in his works, side by side, English and American tools. The advantage is not always in favor of the American ones, he says; but he gives a point which throws some light on the situation, we think, by relating his experience in trying to get crank handles to suit him and his workmen put upon an English tool he was ordering. He stated to the builder of the tool that his workmen and himself liked the solid American handles better than the English style handles, and in ordering the new tool he asked the English builder to put on the American style handles, which the builder refused point blank to do, saying that he considered his own handles far preferable. Such an attitude on the part of tool builders is not unknown in this country, but it seems to us marvelous that any tool builder, here or in Great Britain, should higgle or refuse to meet the wishes of a customer in such an unimportant detail as this. The writer knows that something is to be said in favor of English crank handles. They have been used on American tools, and in certain details at least are excellent for their purpose; but, aside from all this, it would seem to be very poor policy to refuse to put upon a machine tool the sort of handles desired

by a good customer, and the fact, if it is a fact, that any considerable number of machine tool builders can take such an attitude and still remain in business, is significant.

Some New Things.

The engraving presented herewith is of a drill press arranged especially for tapping as well as for drilling, and shows the construction of the machine so well as to make a description scarcely necessary. The modifications are seen to consist simply of a train of gears by which the gear which runs loose on the cone-pulley shaft is driven in the opposite direction from the cone pulley and at a higher

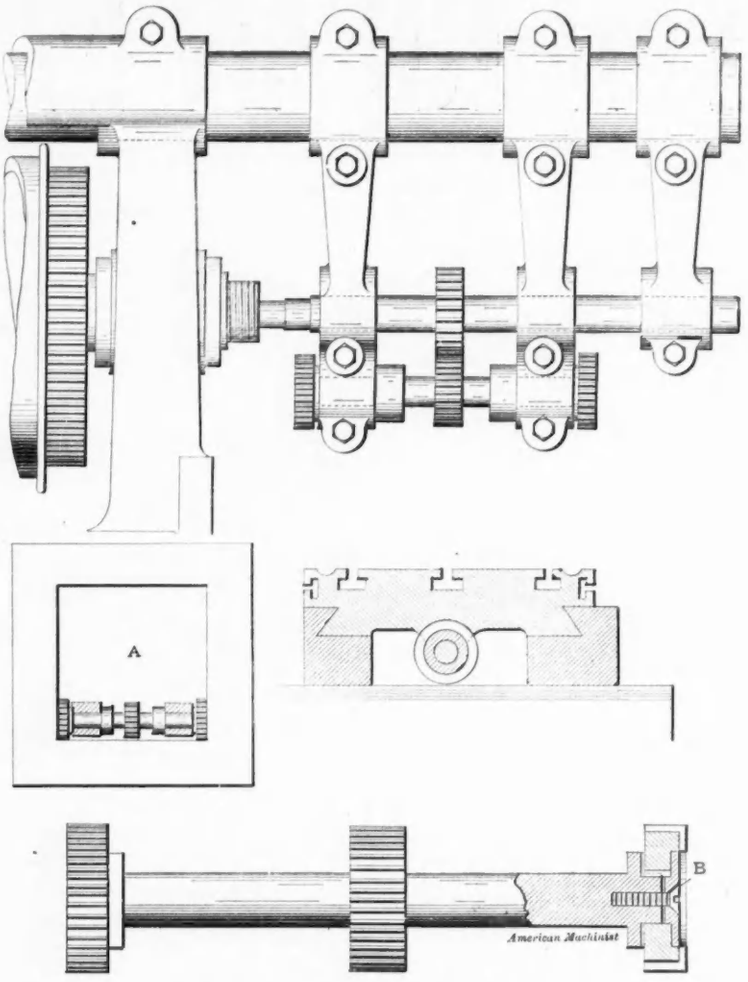


DRILL PRESS ARRANGED FOR TAPPING.

speed in the ratio of 3 to 2. A friction clutch plays between the cone pulley and this gear by means of which the motion of the spindle is reversed for backing out the tap, and the drive being by friction there is little liability of breakages, and the machine can be reversed even at high speeds without shock. The machine handles taps up to 1 inch diameter. The rest of the machine is seen to conform to the standard practice of the day, and it is made by the the Fosdick & Holloway Machine Tool Company, Cincinnati, Ohio.

A SPECIAL MILLING-MACHINE FIXTURE.

The cut shows a milling-machine attachment and a suggestion as to the use of it, which will be readily understood. Hangers or brackets are placed on the overhanging arm of a milling machine, and these carry a cutter arbor parallel with the main spindle of the machine and driven by



A SPECIAL MILLING-MACHINE ATTACHMENT.

spur pinions, as shown. The cutters on the ends of the auxiliary arbor may be sunk into work as shown at *A*, cutting two parallel sides at once at a constant distance apart. This cutting may obviously be continued on two sides for any length, or it will cut all the internal sides of a square of the given dimensions, or the ends of a rectangle, and, using only one cutter at a time, it will of course work within larger dimensions. The method of securing the cutters is shown at *B*. The arrangement has recently been patented by Frank A. Burnham, Cleveland, Ohio.

In our article describing the grinding machine made by Norton Emery Wheel Company, we referred to this machine as the "Norton," whereas the company that makes it calls it the "Walker grinder," after its designer, O. S. Walker, and this is the name we should have given it in our article.

International Patents.

A press dispatch dated December 8 says:

"The International Conference for the Protection of Industrial Property, at which United States Assistant Patent Commissioner Walter H. Chamberlin and Lawrence Townsend, United States Minister to Belgium, were the American representatives, adopted the following resolutions:

"First—The period of exclusive rights previously fixed at six months for [applications for] patents and three months for industrial designs, models and trade marks is extended to a year for the first named and four months for the second named.

"Second—Countries signing the convention enjoy reciprocally the protection accorded by each country to its own citizens against unfair competition.

"Third—Patents cannot lapse because they are not put in circulation, except after a minimum delay of three years, dating from the first application in countries where the patent is allowed and in cases in which the conditions of the patent do not justify causes of inaction."

The Lunkenheimer Company, of Cincinnati, gave a reception to their friends and employees in the new branch works, the evening of November 28, at which there were dancing and refreshments, and, on behalf of the employees, Henry Ritter, superintendent of this department, presented the company with a handsome flag.

Commercial Review.

NEW YORK, Dec. 15, 1900.

SUPPLY AND MACHINERY MARKET.

It is reassuring to note the cheerful tone among the supply trade of this city. This is founded upon the general business of the year or of the fall season or upon what is expected after the first of the year. December trade hardly enters into consideration. Sales of that month are for the most part in seasonable goods, and it might as well be counted out of the machinists' supply calendar. In numerous cases, however, business at the moment is regarded as good as that of a year ago, whatever this may signify. One firm reports that it never before received so many orders as in October and November, but that they were so small as to make a low total. The logical inference from this seems to be that there is plenty of work being done which calls for supplies, but buyers have been distrustful of laying in more than they need for the time being. Another concern has received from an engine builder a foundry and a rolling-mill orders for some big emery wheels such as people generally do not order just at the end of the year. He takes these as signs of confidence. As a matter of fact, there has been no revolution in the nature of the supply business following election. Previous to that event buyers were naturally indisposed to load up with stock that they could not definitely see the use of and by the time it was over inventory time was so close at hand as to dictate a prolongation of this policy till after the first of the year. But withal, there has been a very fair volume of trade moving.

Prices are characterized by steadiness varied by some upward and downward tendencies which may develop after January 1, 1900. An example of their buoyancy is found in bright wire goods, such as screw eyes, on which not long ago reductions were made which brought them down nearly to cost. But they staid there just about one day and then were advancing again. There is a rumor that files will be advanced after the first of the year. Inquiry of a prominent file manufacturing concern brings a reply indicating that while some advance may be made in the future it is by no means certain to be so soon as the time named. The wood screw men this week agreed to hold prices for sixty days longer. The emery-wheel people are talking of getting together to revise prices and make them more uniform, but are expected to defer action till the next century. A slight reduction has been made in steel squares, and twist drills have been cut 5 per cent. on lowest trade price.

Leading power-transmitting machinery concerns give reports tending to sustain the optimist. A certain house refers glowingly to the crowded condition of its works, a state of affairs which is not altogether of recent date. Others say that trade has improved in the last few weeks, one of them having recently brought its works to a satisfactory state of fullness partly by some large Southern cotton-mill work. While there is said to be less cement-mill equipment than there was a year ago, the cotton-mill line in the South is flourishing. A man who has recently been traveling there tells how the factories go up with whole villages as a part of the establishment, comprising houses for the employees of various grades, those for the ordinary hands being better than corresponding houses in New England. The Southern mills are going into the manufacture of heavier cotton goods than the Northern ones, since they are endeavoring to cater to such export fields as the Asiatic where cotton fabrics for outer clothing are called for. December does not seem to be the dull month for the large power-transmitting machinery people that it is for the supply dealers. A wood-pulley house, which experiences a seasonable quietness along with the latter, is outspoken for the hopefulness of prospects.

The reorganization of the Marshall & Huschart Machinery Company, of Chicago, alluded to in our last week's Cincinnati report, is a consolidation of this company and the firm J. B. Doan & Co., of the same city. A new stock company will be formed which will have branches in Cincinnati and Cleveland, Ohio. The company will hold selling agencies for a number of the well-known tool-building companies in Cincinnati, including the Cincinnati Milling Machine Company, the Bickford Drill and Tool Company, R. K. Le Blond Machine Tool Company, the Cincinnati Planer Company, the Lodge & Shipley Machine Tool Company. It is said that Frank M. Huschart, a Cincinnati man, one of the organizers of the company which bears his name, will retire from the business.

A bid was opened December 11 on an electrical traveling machine-shop crane for the Mare Island (Cal.) Navy Yard. There were eight bidders, the Niles Tool Works Company being the lowest at $6,975. Bids have recently been opened for 22 sets of 12-inch gun forgings. The Bethlehem Steel Company and Midvale Steel Company each bid 22c. per pound, to commence work in 60 days and complete in 795 days.

American files are working their way into foreign markets. One of our companies recently had a request from a n an in Birmingham, England, for an agency for its product. The applicant stated that he had previously been selling these files for a dealer there and found them better than any of the foreign-made files with which they were in competition.

In speaking of price agreements, a supply seller recently explained to us some of the methods occasionally resorted to in carrying them on which have come under his observation. They are sometimes made the instrument of chicanery by which a wily manufacturer gets the better of more innocent participants. He will first go around and warn his own customers of what is likely to happen and enable them to protect themselves by placing anticipatory contracts. Then he induces his competitors to make an advance which shall be binding in all sales except those made under contracts then outstanding. After a while some of the customers of the innocent competitors will find out how to buy their goods below the market by placing orders through the customers of the unscrupulous manufacturer who have contracts with him at the old rates. As a result, the latter not only holds his own trade, but gets away that of his competitors, and ultimately breaks the price and disrupts the agreement.

The Seattle (Wash.) Electric Company is to build an electric railway, lighting, power, steam heat and hydraulic plant to cost between $750,000 and $1,000,000. Although the Snoqualmie Falls electric current will be used still, a steam-power plant is to be put in, including two 4,000 horse-power McIntosh & Seymour engines and Babcock & Wilcox boilers.

An imminent financial crisis in Berlin owing to affairs of the mortgage banks has been tided over by the organization of a syndicate of banks for the protection of creditors.

The Buffalo Forge Company writes us that it has found business conditions exceedingly brisk in all its branches. Among recent orders from Pennsylvania is one for a 160-inch three-quarter housing steel plate fan direct connected to a 10x10 inch horizontal center-crank engine for heating and ventilating the offices of the Franklin Air Compressor Company. The contract for heating and ventilating the building of the General Manifold Company, likewise situated at Franklin, has also been received and calls essentially for two 120-inch three-quarter housing steel-plate pulley fans, together with Buffalo Fan System heater, boiler, steam connections and the like. The company is likewise in receipt of a contract from the Buffalo, Rochester & Pittsburgh Railroad for apparatus to go in its shops at DuBois, Pa. For heating and ventilating the machine shops, two 170-inch three-quarter housing fans with 9x10 inch horizontal center-crank direct-connected engines and 14,272 feet of Buffalo Fan System heater, and for heating their roundhouse, one 140-inch three-quarter housing fan, with direct-connected 8x8 inch horizontal engine, and heater, will be installed. There is also included the installation of Buffalo down-draft forges together with a No. 7 B Volume blower, and a 70-inch planing-mill exhauster for use in the forge shop.

CINCINNATI REPORT.

Since our last letter, proprietors of machine-tool, wood-working and other iron machine-making concerns are taking a more optimistic view of the situation. Orders, of which there was a dearth both

foreign and domestic directly after election, are beginning to come in notwithstanding the nearness of the holiday season, and many concerns which meditated shutting down for several days are now contemplating running full time. An important event of the past week with local and machine-tool manufacturers was the visit of Mr. Zortman, of the Brown & Zortman Machinery Company of Pittsburgh. Mr. Zortman was here figuring with those concerns which he represents, concerning an installation of the greater part of the tool equipment of the British Westinghouse Electric and Manufacturing Company's new plant. Several local dealers feel confident of furnishing the majority of the machines to be sent there.

A prominent official of the Cincinnati Machine Tool Company believes that there is a decided improvement in tone but practically all domestic. The demand is general from all parts of the country. Dreses, Mueller & Co. are gratified over the lively demand for their new drill just recently introduced.

The Belmer-Eames Machine Tool Company reports a good and increasing demand for planers of the larger size. Orders are confined entirely to domestic, and this generally holds true of local manufacturers. There seems to be practically no demand from the other side at all. The steadily increasing demand for planers comes principally from Pennsylvania and Ohio. Michigan orders are principally from engine builders.

Cincinnati will be well represented at the Pan-American Exposition in the machinery department. Word comes from there that space has all been taken in an incredibly short time. The Belmer-Eames Company was the first applicant from Cincinnati. At that time affairs were not in shape to make allotment of space. Mr. Eames has just returned from Buffalo where he found he was the last to get in, notwithstanding his enterprise of a few weeks previous. This company intends to make a fine display.

The demand for electric power machinery continues good. Mr. Jacobs, of the Triumph Electric Company, has just returned from a three-weeks' business trip among Eastern agents and reports the general feeling good.

The S. Obermayer Company, foundry supplies, reports foreign demand good in its line. A carload of plumbago for foundry use has just been shipped to London. A small shipment has just been sent to Hamburg. Several carload shipments have recently gone to New York and San Francisco. This company is closing its books for the year. The plant shuts down from December 15 to January 2 for extensive repairs. New machinery and some new branch departments will be installed.

A new machine-tool concern comes from Toledo. Thos. Ricketts & Sons have purchased a plant in Northside and will manufacture machine tools and do electroplating business.

The Lane & Bodley Company, engine builders, have suffered the loss of a portion of their large plant here by fire. Fortunately the machinery room was not damaged at all, save by water. The conservative estimate of the loss is $15,000, with sufficient insurance. Work will be begun immediately to rebuild.

The Bullock Electric Company regards the business outlook for next year as promising even better than the last four years have shown. Many large orders both domestic and foreign have lately been booked. The company has nearly completed the large addition to its machine shop and the new building provided for the brass foundry, boxing and brass polishing departments. When occupied they will nearly double the capacity of the works.

CHICAGO MACHINERY MARKET.

There is quite a tendency toward higher units in the engine trade, and the current activity is more pronounced in that direction than among the smaller engines. The Milwaukee Electric Railway and Lighting Company has about concluded negotiations looking to the purchase of four Corliss compound engines of 7,500 horse-power at greatest economy and 15,000 horse-power maximum capacity. They will be practically duplicates of the large engines bought last year by the Manhattan Elevated Railway Company, of New York. The purchase of such engines as these for a city as small comparatively as Milwaukee indicates that a vast field is opening up for this kind of work. Street railway companies everywhere are feeling the need of greater power in restricted space and recent purchases have been chiefly for larger units. One Western street railway company is now understood to be running its engines at 20 per cent. above normal maximum, to meet the heavy load imposed by increased traffic. The Chicago Edison Company last June ordered from the E. P. Allis Company a compound engine of 4,000 horse-power, greatest economy, and thus became prospective possessor of the largest engine in this city. This company has just ordered from the same builder a vertical compound engine of 5,000 horse-power at greatest economy with maximum of 8,000 horse-power. Deliveries for this class of power cannot be arranged under a year or eighteen months.

For engines of moderate size, inquiry is good, but actual sales are more uncertain. Quite a discrepancy exists in the reports of builders in the matter of current trade, some finding it very quiet and others reasonably active. The former, however, say prospects point to a decided increase in business after the new year opens. The inquiries are coming from all directions, and from all kinds of manufacturers. There is difficulty in specializing any one class that is more active than others. It is remarked, however, that the recent spurt in the construction of cement works throughout the West does not seem to have spent its force, many projects still being under way. On the other hand, less is heard about new beet-sugar plants than at this time a year ago.

The Philadelphia & Reading Railroad Company has purchased from Wickes Bros. vertical water-tube boilers of 2,000 horse-power for new railroad shops to be erected at Reading, Pa., consisting of eight units of 250 horse-power each. The Weber Gas and Gasoline Engine Company has just sold for installation in a coal mine near Pittsburgh, Pa., two natural gas engines of 150 horse-power each, to be belted direct to dynamos, which will run the electric cutters in the mines. A. Van Siclen & Co. report December trade for small steam engines at Chicago very good, much better than two months ago. The city trade is good, but that from the country better.

The Toledo Bridge Company, of Toledo, Ohio, has purchased from the Crocker-Wheeler Company thirty-seven motors ranging from 5 to 20 horse-power and three 100-kilowatt generators from the General Electric Company.

Quotations.

NEW YORK, Monday, Dec. 17, 1900.

Iron—American Pig, tidewater delivery:—

Pensylvania Irons:	
No. 1 X foundry	$16 75 @ $17 50
No. 2 X foundry	15 75 @ 16 50
No. 2 plain	14 75 @ 15 50
Gray forge	14 25 @ 15 00
Alabama Irons:	
No. 1 foundry, or soft	15 50 @ 16 00
No. 2 foundry, or soft	14 75 @ 15 25
No. 3 foundry	14 00 @ 14 50
Foundry forge, or No. 4	13 50 @ 14 00

Prices in the iron and steel markets are steady.

Bar Iron—Base sizes—For good refined brands on dock, 1.50 @ 1.60c., and for same from store, 1.75 @ 1.90c.

Tool Steel—Base sizes—Good standard quality, 7 @ 8c.; extra grades, 10 @ 14c.; special grades, 16c. and upward.

Machinery Steel — Base sizes — From store, 1.70 @ 2c.

Cold Rolled Steel Shafting—Base sizes—From store, 2.50 @ 2.60c.

Copper—Lake Superior, ingot in carloads, 17c.; electrolytic, 16½ @ 16⅝c.; casting, 16½c.

Pig Tin—26 @ 26½c., for 5 and 10-ton lots, f. o. b.

Lead—For wholesale lots, 4⅜c., with .02 @ .05c. extra for carloads.

Spelter—Prime Western, 4.15 @ 4.25c., New York delivery.

Antimony—Hallett's, 9¼c.

Lard Oil—Prime City is quoted at 70c. by a leading authority to-day, but 65c. is still standing in the quotations of the morning papers.

The Paris Exposition—XVI.

An account of some of the more notable features of the exhibit of the Pratt & Whitney Company has already been given, but the machine which attracted the most attention probably is the one shown at Fig. 131, which was fitted up for finishing the sewing machine hand-wheel, Fig. 132. It will be generally conceded, I think, that the problem of producing a machine which will receive the rough castings for these wheels, any number of which castings up to about ten may be put into a specialized form of feeder or magazine and which will then be automatically fed into the machine one after the other and bored out, reamed, faced on both sides of the hub, turned for the belt groove and on the outside of the rim and finally discharged into a suitable receptacle, is not an easy one. Of course its solution has not been worked out all at once, but has been a natural development of the ordinary automatic screw-machine with which machine its builders have had a very wide experience. Even to one who has kept pretty well in touch with the development of such tools there is a fascination in seeing for the first time such a tool at work, and it is easy to see why a European mechanic who perhaps has never before seen an automatic screw machine of any kind at work is apt to be considerably astonished when he runs across this machine in an exhibition, doing a somewhat complicated piece of lathe work over and over again with apparently no attendance whatever except to put the castings into the chute.

Unfortunately it is not possible to get photographs of the machine as it was at work at Paris, but what will answer just as well to make the machine understood are some photographs of a machine fitted up with tools for finishing the wheel shown at Figs. 133 and 134, which has no belt groove, but requires practically equivalent operations. Figs. 135 to 143, inclusive, constitute a sort of cinematograph view of the machine at work and throughout the operation of finishing a wheel. Of course it will be understood that the mo-

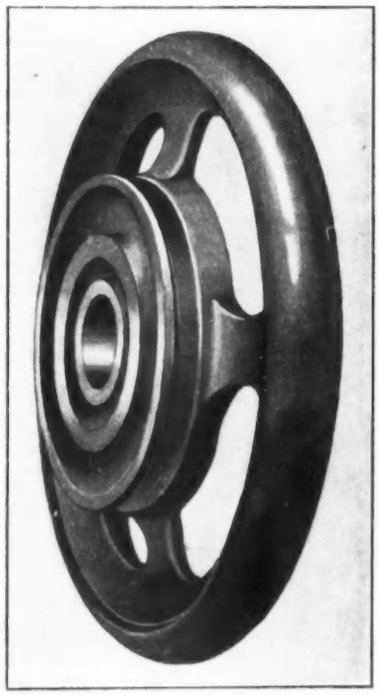


FIG. 132. HAND-WHEEL FINISHED IN SCREW MACHINE SHOWN BELOW.

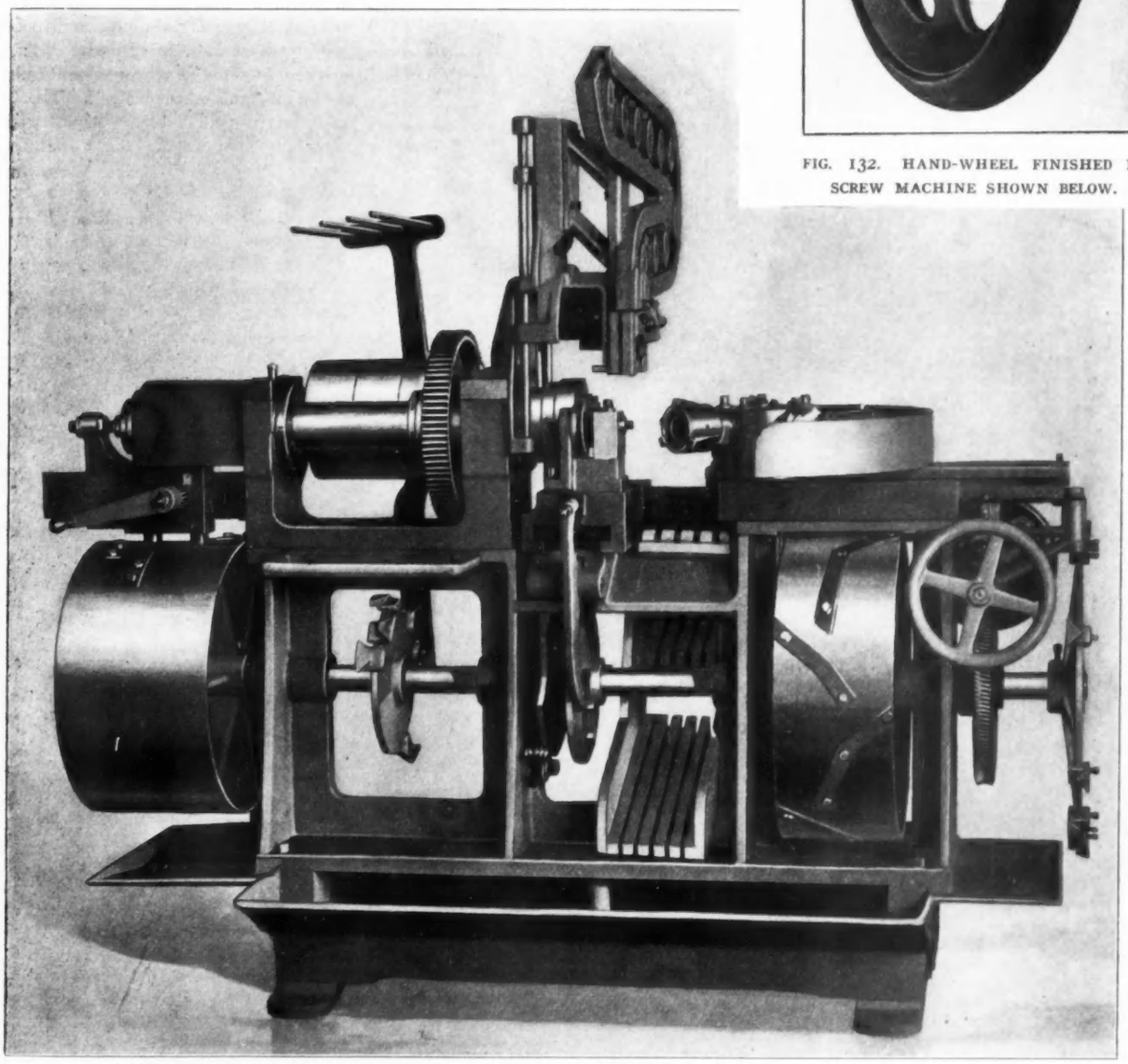


FIG. 131. AUTOMATIC SCREW-MACHINE EQUIPPED FOR FINISHING SEWING-MACHINE HAND-WHEELS, EXHIBITED AT PARIS BY THE PRATT & WHITNEY COMPANY.

tions of the turret and its slide and those for opening and closing the chuck are derived in the ordinary manner for this type of automatic machine and they need no description at this time.

Fig. 135, then, represents the upper portion of the machine with the magazine filled, or nearly so, and ready for operation. It will be noticed that a small portion only of the lowermost wheel casting can be seen, and this casting is held in what is called the work carrier, whose function it is to transfer the castings, one at a time, from the magazine to a position approximately in line with the chuck and the tools, so that it can be gripped by the former and then acted upon by the latter. This work carrier slides vertically upon the two round rods, which also support the magazine, and on which the latter is vertically adjustable, but does not move when the machine is at work.

In Fig. 136 the work carrier is seen in its lower position, to which it has been moved by mechanism actuated by the regular cam wheel. As it starts to descend, the first thing it does is to release the hinged retainer on the front of the lower extremity of the magazine, and this retainer holds the next casting as shown, so that it and the ones above it can descend no farther; it then carries the casting on down into position to be gripped and operated upon; the "transfer chuck," which is the name of the turret tool that is in working position in Figs. 135 and 136, being ready to go forward.

Fig. 137 shows the transfer chuck moved forward by the turret to grip the casting, which it does by means of spring jaws that are forced open to go over and then close upon the hub of the wheel. The casting having been thus gripped by the transfer chuck, the work carrier is ready to return to its first position, as shown in Fig. 135.

In Fig. 138 the transfer chuck has returned to its position under the magazine, and in doing so has released the retainer, allowing the casting, which has been in the meantime held by it, to drop into the carrier, as shown. The transfer chuck is now holding the casting which is in line with the spindle chuck, but is not rotating, although the spindle and its three-jaw chuck continuously rotate. Just here is where one of the neatly solved problems of the machine presents itself. The wheel must be gripped at places which will not allow the jaws of the chuck to interfere with the working of the tools and in this case that place is on the inside of the outer rim, between the arms. That portion of the transfer chuck to which the spring jaws are attached turns freely upon its shank and it is evident that, unless there were some special provision to prevent it, the transfer chuck might present the wheel to the rotating chuck in such a way that the jaws of the chuck would contact with one or more of the arms of the wheel, and if this were to happen the

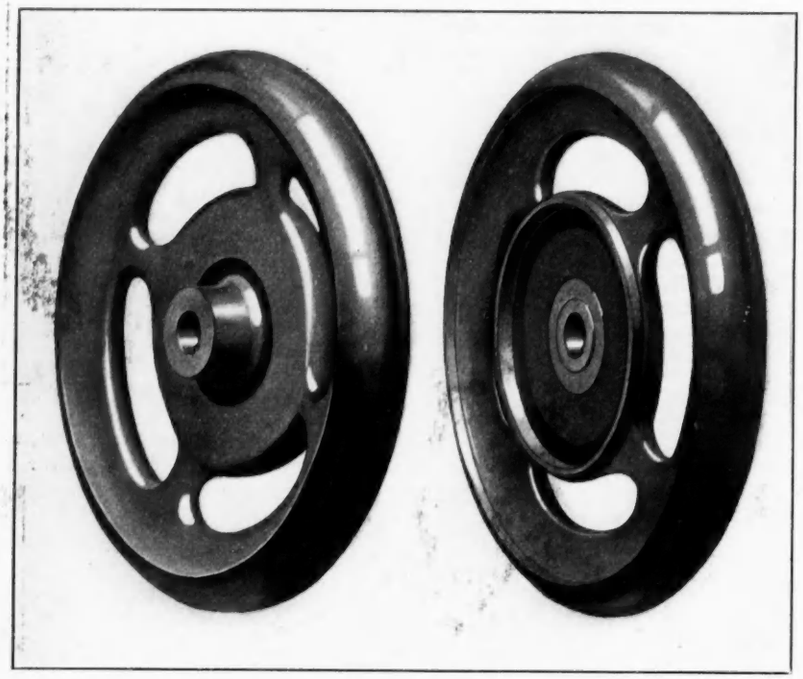


FIG. 133. FIG. 134.
HAND-WHEEL BEING FINISHED IN FIGS. 135 TO 143.

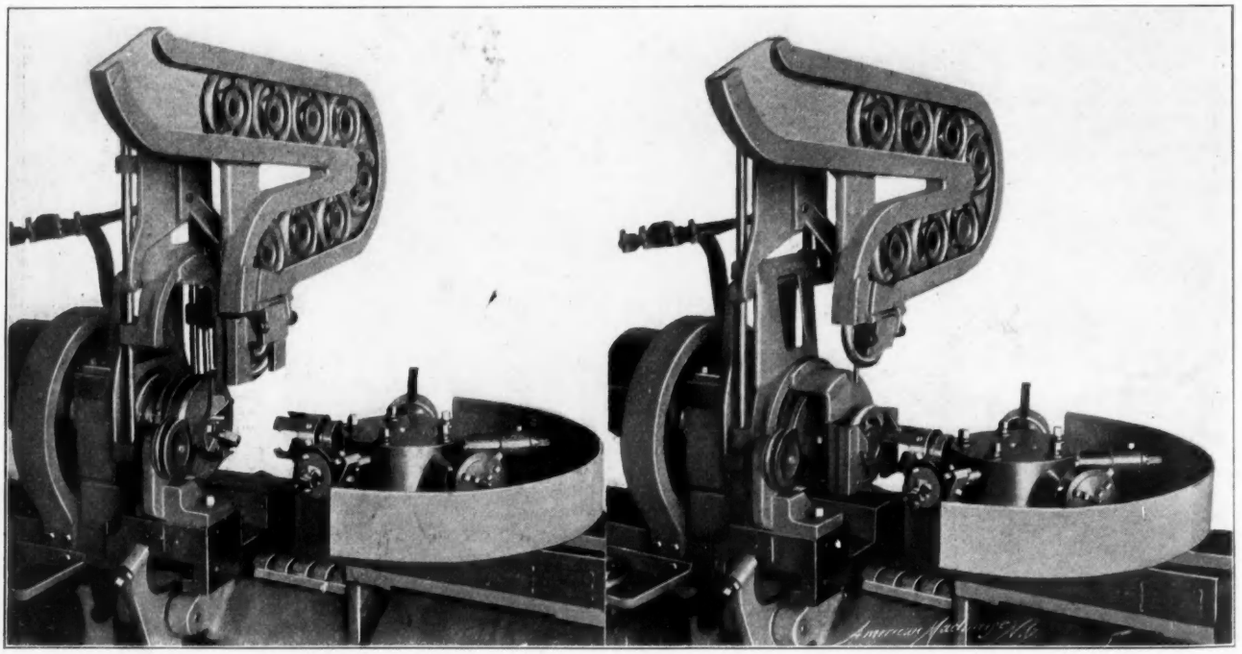


FIG. 135. READY FOR THE BEGINNING OF OPERATIONS. FIG. 136. TRANSFER CHUCK READY TO GRASP WORK.

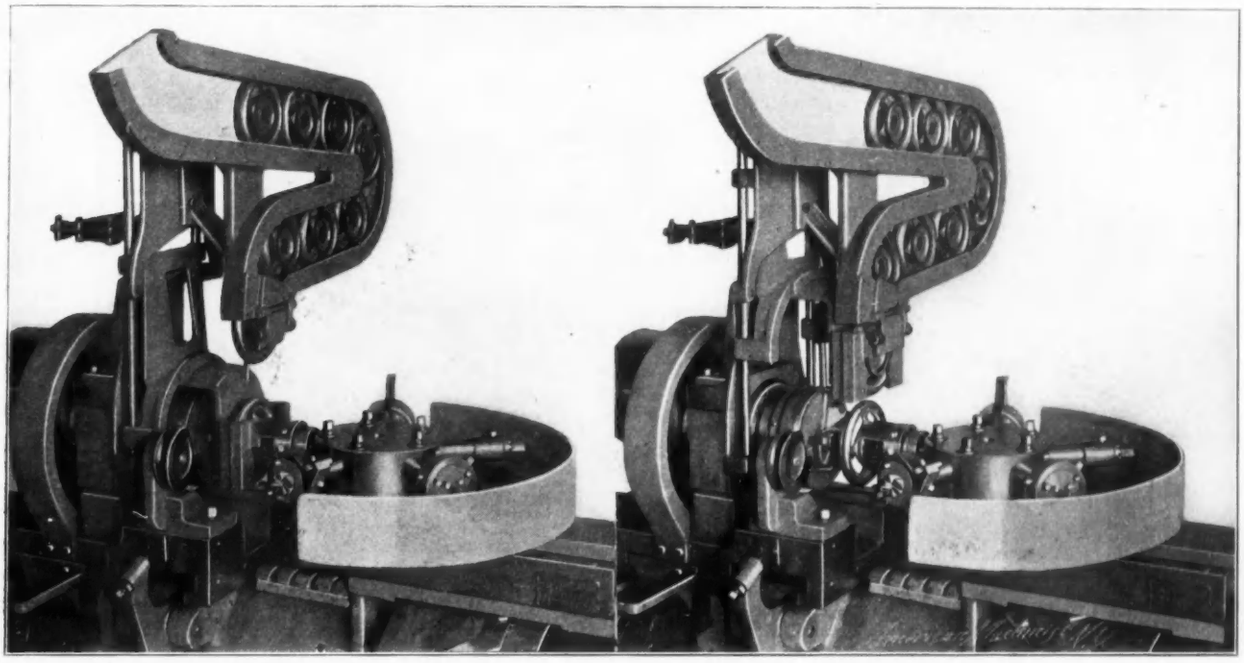


FIG. 137. TRANSFER CHUCK GRASPING WORK.

FIG. 138. MAGAZINE CARRIER RETURNED TO PLACE.

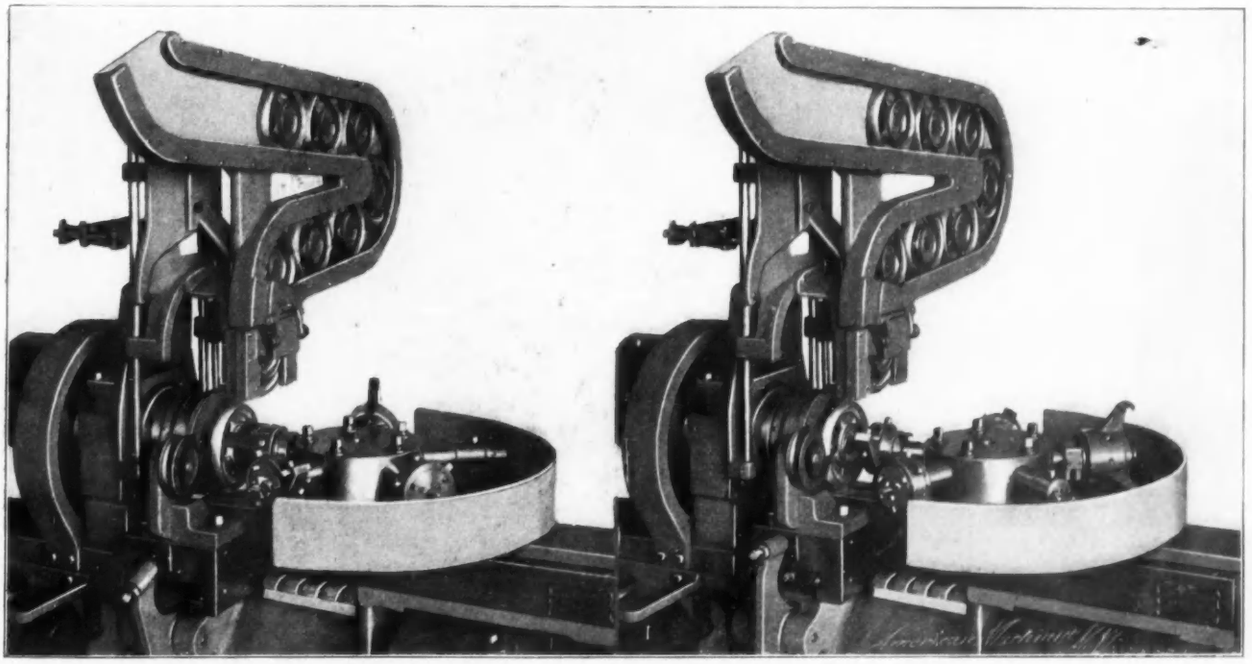


FIG. 139. WHEEL PLACED IN SPINDLE CHUCK.

FIG. 140. FACING AND TURNING OPERATION.

work would be apt to rotate with the spindle chuck and the further advance of the turret slide would be resisted and there would be trouble and repair work for tool makers. To obviate this there is a spring pin fitted into the chuck parallel with the spindle of the machine and at such a distance from the center as to make it possible for it to go between two arms of the wheel. It is pushed forward by a helical spring and projects from the face of the chuck far enough so that it is sure to be the first thing with which the casting comes into contact as the latter is advanced by the transfer chuck. This pin first strikes an arm of the wheel very lightly and is pressed back each time it is struck by the arms at first, but finally by the continued advance of the wheel the pin goes far enough into the space between the arms to engage with one of them and cause the wheel to rotate with the spindle chuck, and the pin is so located with respect to the jaws of the spindle chuck that when it thus engages with the wheel there is a between-arm space opposite each spindle-chuck jaw, and the wheel is pushed into place ready for the spindle-chuck jaws to grip it, which they do in this case by moving outward instead of inward of course.

Fig. 139 shows the position of the parts when this operation of chucking the work has been completed, and the wheel is now rotating with the spindle and is ready for the cutting operations.

At Fig. 140 the roughing-tool box is operating to turn and face the surfaces seen on the hub of the wheel in Fig. 134, the forming tool is also turning the round rim and at the same time the operations of forming and facing the hub on the other

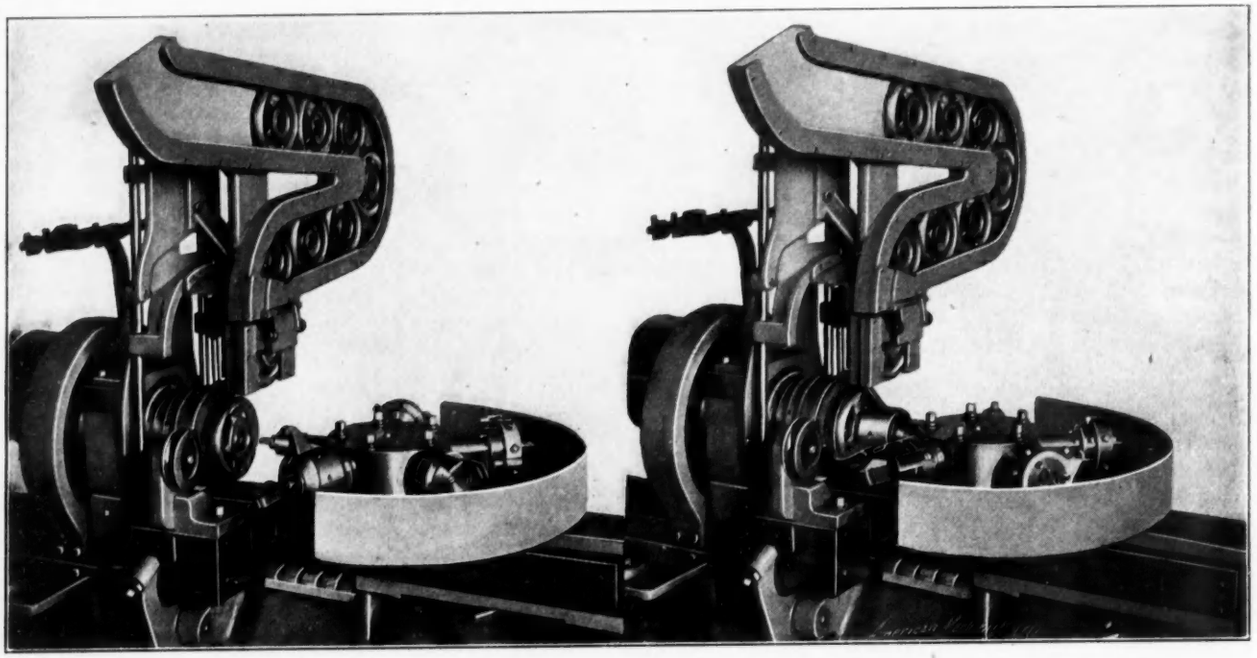


FIG. 141. WHEEL FINISHED READY FOR REMOVAL.

FIG. 142. EJECTOR GRASPING WORK.

side of the wheel, as shown at Fig. 133, are being performed. This last is done by means of tools attached to a bar which passes through the hollow spindle of the machine, and which does not rotate with the spindle. This is shown at Fig. 144, which is a section through the spindle of the machine, and shows also how by a slight modification of the regular arrangement the jaws are made to grip the work by the action of a powerful spring instead of positively as usual, and to thus provide for gripping all pieces of work with practically equal firmness, regardless of the inevitable small variations that will always be encountered in such castings. In this case it will be understood that the sliding collar near the left-hand end of the spindle moves to the left when the work is gripped instead of to the right, as usual.

After this, successive operations are performed upon the wheel by the turret tools, until finally it is as shown at Fig. 141, where the tool that is in working position is the reamer that finishes the hole to size and the facing tool that takes the final finishing cut from the face of the hub. The next tool is the ejector, and at Fig. 142 it is seen in place and advanced to grip the wheel by the rim. The spindle chuck now releases the wheel and the turret moves back; at the same time turning to put the ejector with the wheel in the position shown by Fig. 143, at which point the ejector, by coming in contact with a suitable trip, is opened, and the finished wheel released to fall into a suitable receptacle, and the transfer chuck is just coming into position to take another casting from the magazine.

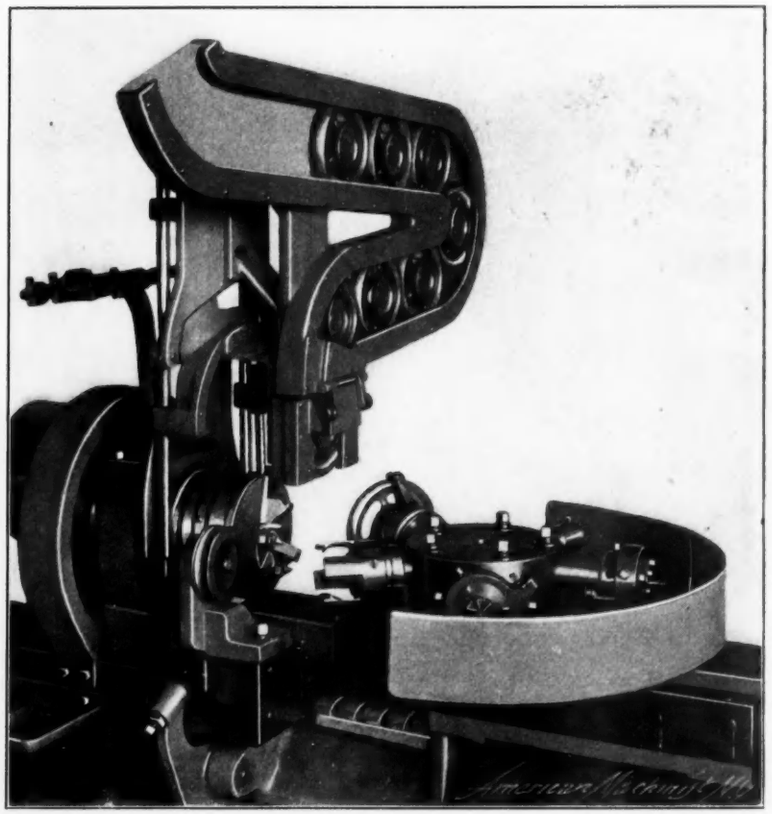


FIG. 143. WHEEL REMOVED FROM CHUCK AND READY TO BE DROPPED.

To see the machine at work—deliberately, but with unvarying steadiness and regularity, changing the speed of the spindle as required for the different tools, requiring only that the driving belt shall be kept in motion by the engine and that the magazine be kept filled with castings—is really one of the marvels of the age, and is a good example of the wonderful development of special machinery and tools by means of which the cost of sewing machines and similar structures is reduced to an insignificant fraction of what it was a few years ago.

At Fig. 145 is a general view of the Pratt & Whitney exhibit in the American machinery building at Vincennes, which will serve to give an idea of the general appearance of the interior of the building. At the right of the Pratt & Whitney exhibit is that of Warner & Swasey, and at

the extreme right of the picture a part of the exhibit of the Ingersoll-Sergeant Company, while in the rear is the wood-working machinery exhibit of the J. A. Fay & Egan Company.

A LOCOMOTIVE FRAME MILLING AND SLOTTING MACHINE.

One of the notable things shown in the German Annex is a machine the precise equivalent of which is not likely to be seen here, because we do not to any great extent build plate-frame locomotives, the tool in question being for the work of milling and shaping the various openings and jaws in such frames. Eight of the plates are laid upon the bed of the machine (Fig. 146), and there are three heads which can then operate upon the frames simultaneously. There is a milling and boring spindle, and at the side of it, upon the same saddle, is a ram which is given a reciprocating vertical motion for shaping or planing such portions of the work as cannot well be milled—corners of small radius, etc. It will be noticed that the tool is not held directly in the ram, but in a holder, which can be rotated by means of a worm and the crank handle shown, and can also be moved or adjusted to any required distance from the center, so that by its rotative movement it will shape a corner of the desired radius. Some of the openings in plate frames have oblique sides, and the milling or planing of these is provided for by setting the cross-rail at the desired angle. It will be noticed that where the uprights at the rear of the machine rest upon the saddles at that side, T-slots are provided, and these are circular, with the

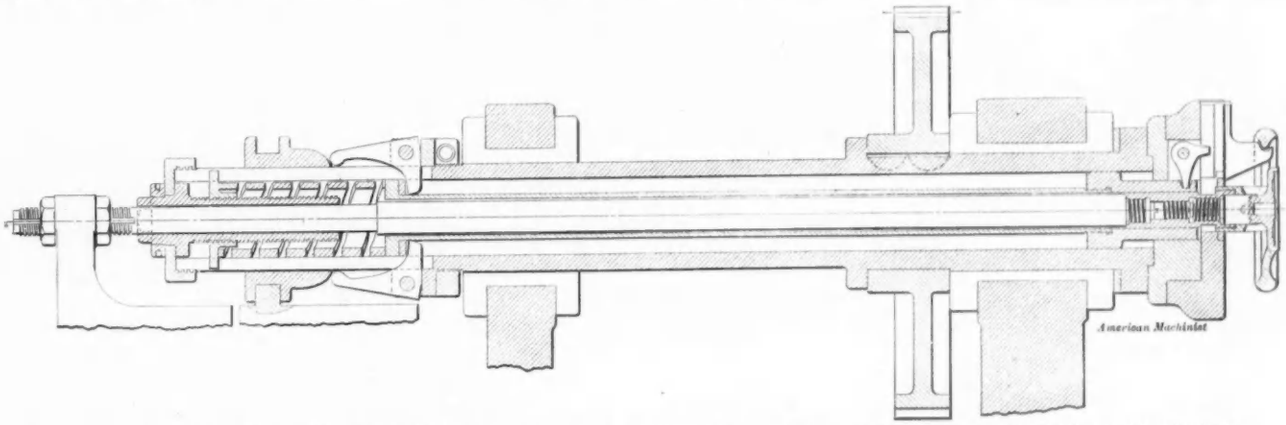


FIG. 144. SECTION THROUGH SPINDLE AND CHUCK OF PRATT & WHITNEY AUTOMATIC ARRANGED FOR FINISHING HAND-WHEELS.

FIG. 145. GENERAL VIEW OF PRATT & WHITNEY COMPANY'S EXHIBIT IN THE AMERICAN MACHINERY BUILDING AT VINCENNES.

centers of their arcs in the center of the opposite saddle, so that by loosening the nuts the cross-rail can be set to the required angle for the work. An electric motor attached to each tool carriage does the driving, and there are longitudinal and cross automatic feeds. The bed of the machine is 11,800 m/m (38 feet 9 inches) long and 1,650 m/m (5 feet 5 inches) wide. The longitudinal feed being by means of racks placed in the bed, the feed for each tool carriage is independent of all the others. With three men to operate the machine, the time given in which to finish eight frame plates is forty hours. The machine is built by Collet & Engelhard, Offenbach-Main, Prussia. F. J. M.

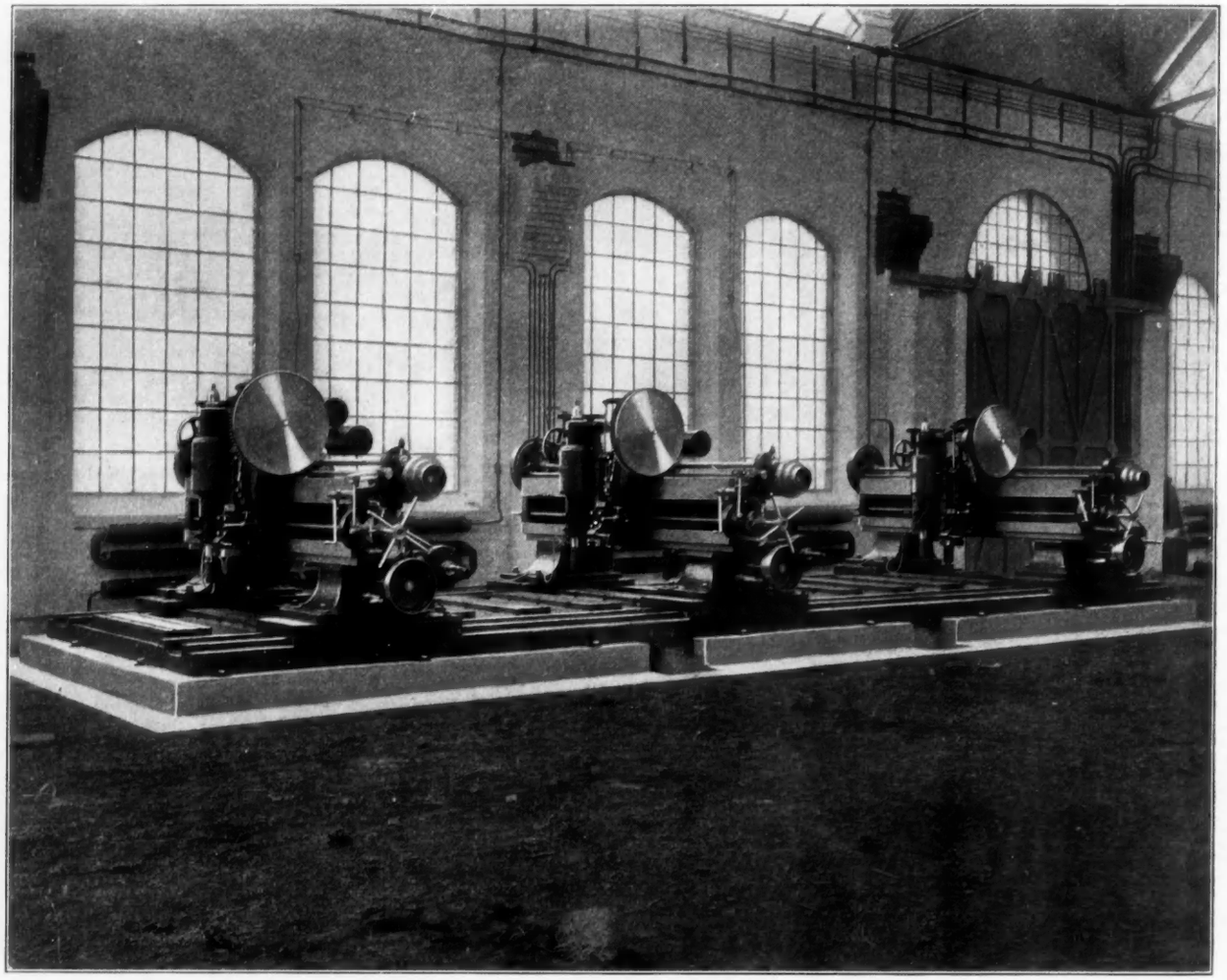


FIG. 146. LOCOMOTIVE FRAME MILLING AND SLOTTING MACHINE SHOWN AT PARIS BY COLLETT & ENGLEHARD.

A Record of the Early Period of High-Speed Engineering.*

BY CHARLES T. PORTER.

This meeting, following close upon the death of John F. Allen, seems a fit occasion to give to the society some reminiscences of Mr. Allen, and of the infancy of high-speed steam engineering.

*Presented at the New York meeting (December, 1900) of the American Society of Mechanical Engineers.

I am glad of the opportunity to pay my tribute to the memory of a friend, of wonderful engineering genius and insight and noble character. The subject has, too, for me a singular interest, as affording a prominent example of incidents which occur in the life of everyone, when events trivial in themselves are afterwards seen to have been big with consequences.

One morning in the winter of 1860-61, Mr. Henry A. Hurlbut, then of Swift, Hurlbut & Co., wholesale dealers in hats, at No. 65 Broadway, and who had become interested in my governor manufacture, called upon me to tell me that a friend of his, Mr. Henry A. Burr, manufacturer of felt-hat bodies, at the corner of Frankfort and Cliff streets, in New York, had been having trouble with his engine. He thought my governor was just what he needed, and asked me to accompany him to Mr. Burr's office, where he would give me the advantage of his personal introduction. In the interview with Mr. Burr which followed, I did not have an opportunity to say a word. After Mr. Hurlbut had explained the object of our visit, Mr. Burr replied that he had had a great deal of trouble with the regulation of his engine, and had thought seriously of getting a Corliss engine in the place of it; but, two or three weeks before, the builders of the engine had sent him a very skilful engineer, and since he came there had been no further trouble, so he should not need my governor. He invited us to see his engine, in which—since it had been taught to behave itself—he evidently took much pride. We found a pair of beam engines of about 5-foot stroke, running at twenty-five revolutions per minute, made by Thurston & Gardiner, of Providence. They had the usual poppet valves and the Sickles cut-off. This was made adjustable, and was regulated by the governor. At the time of our entrance, Mr. Allen, the new engineer, was on the scaffold, lubricating the beam centers. Mr. Burr called him, and he came down, and at Mr. Burr's request explained to us the liberating mechanism and what he had done to make it work satisfactorily. The regulation did not appear to me to be very close, and I made a determined effort to induce Mr. Burr to substitute one of my governors. I showed him a cut of the governor, and pointed out its combination of power and sensitiveness, but all in vain. He was satisfied with things as they were,

and I went away crestfallen, having lost not only the sale of a governor, but also an opportunity for a triumph in a very important place. But I did not know to whom I had in fact been talking. As we were leaving, Mr. Allen asked me if I would call some time and see him—he had something he thought I would be interested in. I called soon after. He told me he had a plan for a variable cut-off, with positive movements, which he thought would avoid objections to the liberating gear. He had had it in his mind a good while, but did not think it could be used, because the governor could not handle the block in his link so as to maintain steady motion, and he had been inclined to abandon the idea; but when he heard me describing my governor to Mr. Burr it occurred to him that that governor would do, and he would like to explain it to me. He had no drawing, not a line; the design existed only in his mind. He put down his ideas, as he fitly expressed it, with chalk on the engine-room floor, and that rude sketch represented the perfectly matured system.

When his plan came to be analyzed, it was found that everything had been thought out and provided for, even to equalizing the opposite port openings, and compensating for the unequal piston motion produced by the vibration of the connecting rod, so as to make the opposite diagrams identical. But the wonder did not stop there. Mr. Allen had remedied the defect in the link motion of making a narrow opening for admission when cutting off early, by employing a four-opening admission valve of unique design at each end of the cylinder, and also by greatly enlarging these openings.

The four-opening valve required four seats in one plane, and it was important that these should be as narrow as possible. For this purpose Mr. Allen employed the Corliss wrist-plate movement to reduce the lap of the valve, and by an elegant improvement on this movement he made it available also to enlarge the openings. This improvement consisted in the employment of two rockers having a common axis, and separate driving arms, as well as driven arms, for each valve. The driving arms were made to vibrate a long way towards their dead points, and the increased opening movement in arc thus obtained was imparted directly to the valve. This combination of an enlarged opening with a reduced lap was perhaps the most surprising feature of Mr. Allen's system.

The four-opening equilibrium valve, soon afterwards invented by Mr. Allen, required but two seats in one plane. The seats could therefore be made wider. For the sake of simplicity, this division was then dispensed with, and the same enlarged openings were obtained by increasing the length of the driven arms, submitting to the increased motion on the lap.

That that remarkable system of parts and movements should have been elaborated in the mind of a man who had no knowledge of mechanics, except what he had absorbed in engine-rooms, must stand among the marvels of inventive power.

After Mr. Allen had explained his plan to me, I expressed my confidence that my governor would meet its requirements, and observed that it would enable a variable cut-off engine to be run as fast as a locomotive. Somewhat to my surprise, he replied that he wanted his cut-off compared with the liberating cut-off turn for turn; that it had an advantage which he thought would cause it to be generally preferred at the same speed.

I was then ignorant of his state of mind on that subject, or of what had produced it. I learned these afterwards and will state them here. In one of our interviews, in reply to my question what had led him to make this invention, he told me it was his experience when he was engineer of the propeller "Curlew," a freight boat running on Long Island Sound, between New York and Providence, which had a Corliss engine. He became impressed with what he thought to be a serious defect in the liberating system. The governor did not control the point of cut-off, but the point of release; this point being at the beginning of the closing movement of the valve, while the cut-off took place at the end of that movement. When that engine was worked up to nearly its capacity, as was the case in a ship, the port was opened wide, and quite an appreciable time elapsed between the release and the cut-off. During this interval, the piston advanced considerably, and if the engine ran fast enough, it might go to the very end of the stroke. He said in smooth water they had no trouble, but in the open ocean, going around Point Judith, it was always rough,

JOHN F. ALLEN.

and sometimes in stormy weather the screw would be thrown quite out of the water, and the engine, having no flywheel, would race most furiously. The faster it ran, the farther the steam would follow, and was pumped out of the boiler very rapidly. Springs were employed to accelerate the closing movement of the valves, but in these cases they seemed to be of little use, and were continually breaking. He saw that this difficulty could be avoided only by a positive motion gear which would enable the governor to control the point of cut-off itself; and, accordingly, he set himself to work to devise such a system. We know now that this judgment,

formed from observations made under very exceptional conditions, was not well founded. The difficulty in question does not practically exist in engines having flywheels and the present improved liberating gear; but the experience naturally made a deep impression upon Mr. Allen's mind, and led to the invention of the positive-motion system.

This he did not tell me at the time, so that I was at a loss to understand his reluctance to admit what was really the great value of his invention. However, I told him I would be willing to attempt its introduction, provided he would allow me to apply it at once to a high-speed engine —that being a field into which the liberating system could not enter. To this he assented, and I took him directly to the office of Mr. Charles B. Richards, now Professor of Mechanical Engineering in the Sheffield Scientific School of Yale University, who then had an office on Nassau street, where he was doing business as a mechanical expert and designer of machinery, and who had done some excellent work for me. I engaged Mr. Richards to make an analysis and drawing of Mr. Allen's system under his direction, and soon afterwards gave him an order for the plans for an experimental engine, 6x15 inches, to make 160 revolutions per minute.

The subject of an indicator directly presented itself. Mr. Allen invited Mr. Richards and myself to his engine room, and took diagrams for us with a McNaught indicator. This was the first indicator that either of us had ever seen. Indicators were then but little known in this country. The Novelty Iron Works made a very few McNaught indicators, almost the only users of which were the Navy Department and a few men like Ericsson, Stevens, Sickles and Corliss. I told Mr. Richards that we n ust have a high-speed indicator, and he was just the man to get it up for us. He went to work at it, but soon became quite discouraged. He could not see his way. I told him I was not able to make any suggestions, but the indicator we must have, and he had to produce it. After some months he handed me a drawing of an indicator, which has never been changed, except in a few details. This important invention, which has made high-speed engineering possible, came from the hands of Mr. Richards quite perfect. Its main features, as is well known, are a short piston motion against a short, stiff spring; light multiplying levers, with a Watts parallel motion, giving to the pencil very nearly a straight line of movement; and a free rotative motion of the pencil connections around the axis of the piston, which itself is capable of only the slight rotation caused by the compression or elongation of the spring. Elegant improvements have since been made, adapting the indicator to still higher engine speeds; but these have consisted only in advancing further on the lines struck out by Mr. Richards. In fact, this was all that could be done—giving to the piston a little less motion, lightening still further the pencil movement, and making the line drawn by the pencil more nearly a straight line.

I took Mr. Richards' drawing to the Novelty Iron Works and had an indicator ready for use when the engine was completed. The engine was made by the firm of McLaren & Anderson, on Horatio street, New York. It was set up by the side of their throttle-valve engine, and was substituted for it to drive their own machinery and that of a kindling-wood yard adjoining, for which they furnished the power. It ran perfectly from the start, and saved one-half of the fuel. In throttle-valve engines in those days the ports and pipes were generally so small that only a part of the boiler pressure was realized in the cylinder, and that part it was hard to get out, and nobody knew what either this pressure or back pressure was. I have a diagram taken from that engine, which is here reproduced, Fig. 1.

The success of this engine was such that I determined to build a larger engine for the approaching London Exhibition of 1862, and the next May found an Allen engine, 8 inches by 24 inches, making 150 revolutions per minute, in operation in that exhibition, with a success which is a matter of history. The diagram, Fig. 2, was taken from that engine.

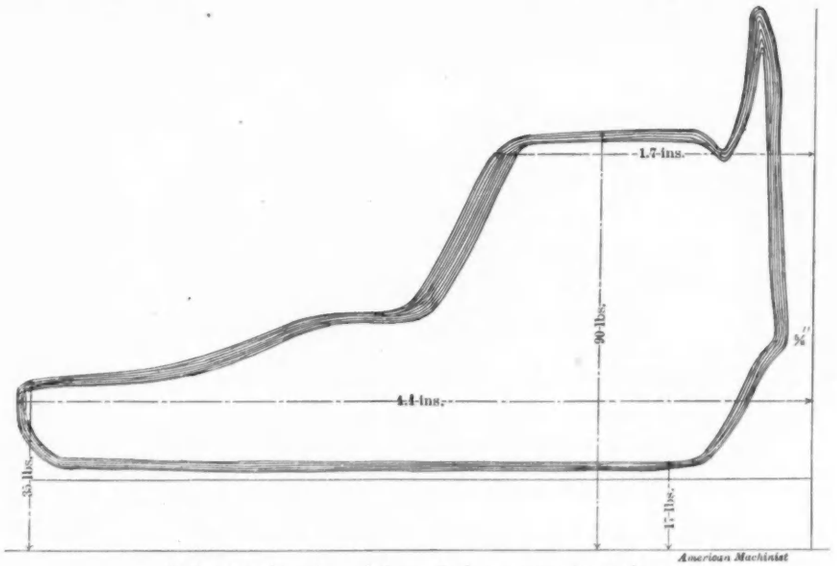
I found myself in queer company, and I afterwards learned why. There were twenty-four engines in the exhibition, mostly English, all small and all non-condensing, as no water for condensing purposes was obtainable in the locality. That, however, did not strike me as odd, for I had never seen a condensing engine in any public exhibition. They were all quite inferior, what the English would call "a rum lot." A large battery of boilers was unable to maintain the steam pressure, which had been fixed at 70 pounds on the square inch. Especially when the Gwynne centrifugal pump was running the pressure always fell a pound a minute, so that it never was allowed to run over 15 minutes at a time. Mr. Allen came over in the fall, and soon after his return he sent me a drawing of his equilibrium 4-opening valve and adjustable pressure-plate, which completed his design, according to which the engines have since been made.

I was enquired of by the eminent firm of Easton, Amos & Sons—whose works were located in the Borough of Southwark, in London, a region which Dickens has made famous, who were the consulting engineers of the government, and were builders, and I believe at that time the only builders in England, of compound engines on the Woolf system—if I considered that it would be safe to run my engine at 225 revolutions per minute. Of course I knew no more about it than they did, but I did not hesitate to say that in my judgment it would be perfectly safe. On the strength of that "opinion" they purchased the engine, and set it up in their own works to drive their foundry blower through a frictional gearing, 9 to 1. It fully justified my opinion, and did this work so easily that I proposed to them to use it to drive the whole works. Everything there was compact in a degree to which we were not accustomed. The foundry was separated from the machine shop only by a brick wall, and the boilers were on the main floor of the machine shop itself. The engine got along pretty well until they were grinding shafting with large grindstones at the same time that the foundry blower was on. That was too much for it, because the addition of 50 per cent. to the speed of my engine had made the ports and valve movements very insufficient. However, they gave me a portion of the works to drive.

The year 1863 was devoted by me partly to the introduction of the indicator and partly to the revision of the engine plans, including the introduction of the equilibrium valves. Among other things, I designed the present engine bed.* The manufacture of the engine in England, according to these revised plans, was commenced in January, 1864, by the firm of Ormerod, Grierson & Co., of Manchester. In the year 1866 this firm failed, and on the invitation of the Whitworth Company I transferred the business to them.

The Whitworth Company sent to the Paris Exposition of 1867 four Allen engines, and also a sectional model, the latter being a complete small engine with the upper half of the cylinder and steam chest planed off, showing the valves in section, all being exhibited in slow motion. Three of the engines were 6x12 inches. Two of these were employed to drive an electric apparatus for the British Lighthouse Board, and were run at 300 revolutions per minute. The third was run idle at 500 revolutions per mniute, to illustrate the adaptation of Mr. Allen's system to very high speed. For this illustration careful preparations were made. The flywheel was a light, solid disk, 2 feet in diameter. The reciprocating parts weighed only 40 pounds, and were exactly balanced by the counterweight. The bed was filled with lead. The whole was set on a single block of Caen stone, 3 feet thick. This engine was shown, for one or two minutes several times a day, at its top speed by holding up the end of the governor lever, so bringing the block to the top of the link and letting it hum. It ran, as nearly as could be judged, at over 2,000 revolutions per minute. When the governor resumed control and the speed slowed down to 500 revolutions, it always seemed to the bystanders as if the engine were going to stop. The fourth engine was 12x24 inches, making 200 revolutions per minute, and driving a portion of the English machin-

*This bed was adopted by Tangye Brothers, of Birmingham, several years afterwards.



Engine 6 x 15 in.—160 revolutions. Card was run over twenty times.

FIG. 1. DIAGRAM TAKEN SEPT. 13, 1861, FROM THE FIRST ALLEN ENGINE BY THE FIRST RICHARDS INDICATOR.

ery exhibit. This was a condensing engine.

At the London Exhibition of 1862, one of the first questions asked me, and which I heard often afterwards, was: "How do you drive your air pump?" The form of the question, it will be observed, assumed that of course the engine had an air pump, which it was understood could not be used there. At first I innocently replied that the engine was a non-condensing engine, and had no air pump, little aware of the effect this answer had on the mind of the questioner. After a while I became by degrees conscious that I was among conditions and habits of thought very different from those to which I had been accustomed. The fact was that, from an engineering point of view, to the English mind a non-condensing engine was no engine at all. They were always simple and cheap engines, built mostly for export—commercial goods only. All engines of the least consequence in England were condensing engines, and as my engine claimed to be at least respectable, it must have an air pump, of course. As my destitution in this respect became known, I came perilously near to being dropped, and never knowing why.

Easton, Amos & Sons frankly expressed to me the consensus of engineering opinion, that high speed, while successful in non-condensing engines, was not to be thought of for condensing engines. In the then existing state of the art, this condemnation was unavoidable. The air pump must run with the engine, stroke for stroke. At high speed it would lose its efficiency for two reasons—the valves would not seat themselves in time, and the air and water would be churned into foam. The question with which I had become so familiar, slightly changed to the form, "How are you going to drive your air pump?" was before me, imperatively demanding an answer.

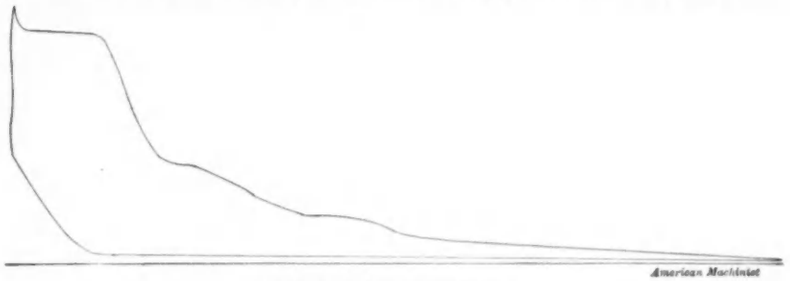
I wrestled with this problem all the while I was with Ormerod, Grierson & Co., and when I went to the Whitworth Company, had a design ready to be put in execution.

This condenser was planned on a somewhat new constructive principle. It was a square box, set behind the engine and divided into three compartments, one occupying the lower and two the upper half. One of these latter was the condenser and the other the hot well. The bottom of the condenser was inclined slightly downward from the hot well. The valves were large, with a short lift and were closed by springs.

In the lower chamber was a single-acting ram, connected with an extension of the piston-rod and working in a body of water. It was hollow, floating in the water, and pointed so as to move through without disturbing it. The areas were such that a motion of the ram of one foot produced a rise or subsidence of the water of one inch. The air, it will be observed, remained above the water, was drawn in last and expelled first. There was no place where a particle of air could be trapped.

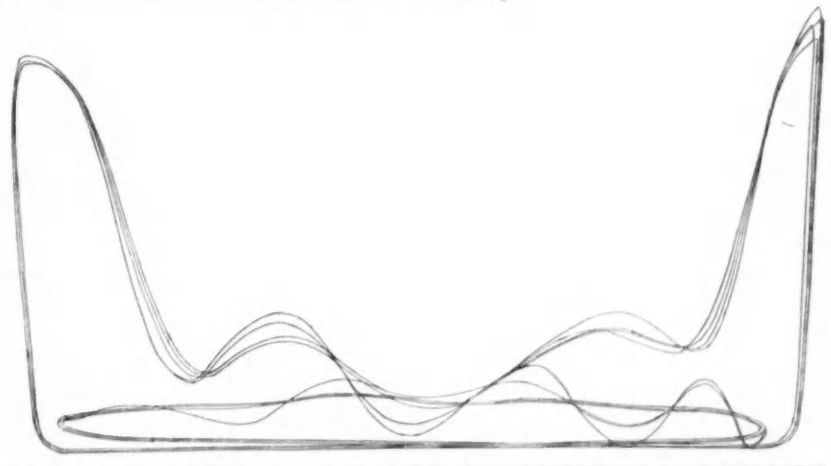
It being evident that this condenser would answer, I put three of them in hand at once, for three engines to be run at 150 revolutions per minute, and, there being no alternative, I sent the first one that was ready to Paris to be tested in the Exposition; and, moreover, determined to settle the question decisively as to the adaptation of high speed for condensing engines, I put the speed of that engine up to 200 revolutions per minute, and I had the best vacuum in the Exposition, where several condensing engines were shown, some very large.

The gage stood always between 28 inches and 29 inches. This condenser was not patented. Twenty-five years after I learned that it had come into general use in Europe.



Engine 8 x 24 in.—150 revolutions.

FIG. 2. DIAGRAM FROM THE ALLEN ENGINE BY THE RICHARDS INDICATOR, INTERNATIONAL EXHIBITION 1862.



Engine 12 x 24 in.—200 revolutions. Diagram smaller than the original.

FIG. 3. DIAGRAM FROM ALLEN ENGINE, PARIS EXPOSITION 1867

The French engineers would not accept the reality of this vacuum unless it should be shown by a Deluel mercurial gage. So I went to the establishment of Deluel & Co. and obtained a gage, and the same night drilled the condenser to put it on; but no tap could be found to fit the thread. I had to plug the hole, and went the next day to the Deluels with my complaint. They very politely loaned me a set of taps, informing me, with the greatest apparent satisfaction, that this was a thread peculiar to their house. The new gage agreed exactly with the old one, a Bourdon gage, and the French engineers were satisfied.

The diagram, Fig. 3, was taken from this engine. It is the only one from both ends that I have preserved, and was drawn on double the usual scale.

The inequality of the opposite diagrams is due to the change of load while the instrument was being transferred from one end of the cylinder to the other.

The port areas and valve movements were insufficient, but they were designed for a speed of 150 revolutions per minute.

The Richards indicator at 200 revolutions, and with a 16-pound spring, drew a waving line. The vibrations interested me. The lines being flowing showed an absolutely frictionless action. I could touch the pencil to the paper so lightly that the vibrations would continue to the end of the return stroke, or could press it so hard that they nearly disappeared, but their mean was always the same.

This exhibit produced a marked impression. Mr. John Hick, of Bolton, since head of the firm of Hick, Hargraves & Co., and then the largest builder of stationary engines in England, spent a long time every afternoon of his ten days' stay in Paris watching the running of this engine. He told me that no amount of testimony would have made him believe such a performance to be possible. If my engine shown in 1862 had made anything like the same impression on his mind, he would have made me a proposition, but it did not. The idea of employing an engine running at that speed as a condensing engine did not occur to him, and if it had, he would not have given it a moment's consideration. So the engine failed to interest him. He had since made other arrangements, which it was then too late to change.

I received three propositions from French builders. The first two, made nearly simultaneously in the summer, were both accepted in the autumn, the parties agreeing to work together. I was sorry when this obliged me to decline an application, which came just before the close of the Exposition, expressed in the most complimentary terms, from Farcot et Cie., the leading builders of stationary engines in France, and the largest exhibitors of them at the Exposition, after they had observed the running of the engine for nearly seven months.

Mr. Allen was sent over to Paris by the parties interested in the United States to examine for himself what was being done and report to them. His report was so satisfactory that I was written to, to leave everything abroad in the best condition I could, and return home to engage with Mr. Allen in the manufacture of the engine, for which ample capital would be furnished. I found, however, that the financial provision made for turning to account the position which I had gained was ridiculous, while both the shop, which I found already started, and its location, on Fourth avenue, in Harlem, were equally absurd; especially when, two or three years later, the railroad was put in a trench on that avenue, and each side of it was occupied for more than a year by temporary tracks in constant use by three roads, cutting off all communication with the premises; but as nothing better could be done, we struggled along in a small way with meagre facilities until the great financial revulsion of 1873 found the business in excellent condition to be abandoned.

During this period Mr. Allen gave to our business the last contribution of his inventive skill. We had discussed the subject of water-tube boilers quite fully, and considered especially the Field internal circulating tube. One day Mr. Allen said to me that he had an idea that by inclining the tube at a small angle from the vertical position, a better circulation could be got than from an internal tube. This proved to be an inspiration of genius, which, in my judgment, will form the fundamental feature of the water-tube boiler in its finally protected and surviving form.

In 1871 Mr. Allen, wearied of our absurd position, and also, as is often the case with genius, longing for new worlds to conquer, sold out his interest in the engine business, and devoted himself thereafter to the development of the pneumatic riveter and the air compressor. My acquaintance with the latter part of his career is not sufficient to enable me to speak of it so definitely as others can do.

Mr. Allen's locomotive valve was presented in a paper by Mr. Quereau, at the late Washington meeting. In the discussion of that paper, I omitted to state that the value of balancing that valve—as, indeed, every locomotive valve—was fully realized by Mr. Allen. In plans for that valve made by myself, a free balancing ring was shown on the back, having an internal area equal to that of the exhaust cup, and communicating with it.

I may perhaps be pardoned for a word respecting the change of name of the engine. I had sometimes been asked by my friends what I had to do with the Allen engine. It occurred to me that I had considerable to do with it. So, when, after a suspension of three years, I was about to resume its manufacture in its finally matured form, to be carried on by myself individually, it seemed not only proper, but also demanded in the interest of the business that it should be revived as the Porter-Allen engine.

In my intercourse with Mr. Allen I was always impressed with the depth of his penetration and the general soundness of his judgment. He lived in a region of engineering and mechanical principles, with which his familiarity was certainly intuitive. Deprived of all early advantages, the world gave him nothing, but he will be counted among those who have given much to the world.

Nut-Facing Machine.

The accompanying illustrations show a new nut-facing machine made by the Detrick & Harvey Machine Company, of Baltimore, Md. The leading idea in its design is to provide means for backing off the nut by power when finished, so dispense with the use of a wrench or hammer, and thus expedite the work and also prevent bending the pintle as frequently happens from the use of a hammer. The general appearance of the machine is well shown in Fig. 1, but the feature described is best seen in Fig. 2. The spindle is shown at *a*, the usual pintle being at *b*. Mounted on the end of the spindle is a sleeve *c* which is free to stand still while the spindle revolves or to slide upon it. At its end is a bush *d* having a hexagonal hole fitting the nut freely. A flange *e* has a notch *f* which, when the machine revolves backwards, may be made to engage with a key *g* attached to the shoe *h* of the swivel-mounted lever *i* by depressing the handle at the left.

In use the operator pushes the lever *i* to the left in Fig. 1, or away from the observer in Fig. 2, and thus causes the sleeve *c* to slide forward until the bush *d* overhangs the pintle. The nut is then inserted and pressure downward on the lever produces sufficient friction between the flange *e* and the shoe *b* to hold the bush and nut from revolving and thus screw the nut on the pintle as the spindle revolves. When the nut reaches its seat where it is driven by the pintle as usual, the flange *e* slips in the shoe *h* and the operator draws the lever to the right in Fig. 1, thereby sliding sleeve *c* and bush *d* backward on the spindle to the position of Fig. 2 and thus exposing the nut. When the lever is released by the hand the spring below raises it and thus prevents noise by the passing of the notch *f* over key *g*. The tool is now pushed forward by the handle at the right in Fig. 1. The facing completed, the tool is withdrawn and the spindle reversed by operating the treadle below or the handle in front of the cone pulleys, either one serving to shift a clutch between the gears on the main spindle. The lever *i* is now depressed and, the machine running backwards, the square end of notch *f* engages with and stops the revolution of sleeve *c* and bush *d*, and the full power of the machine is exerted to

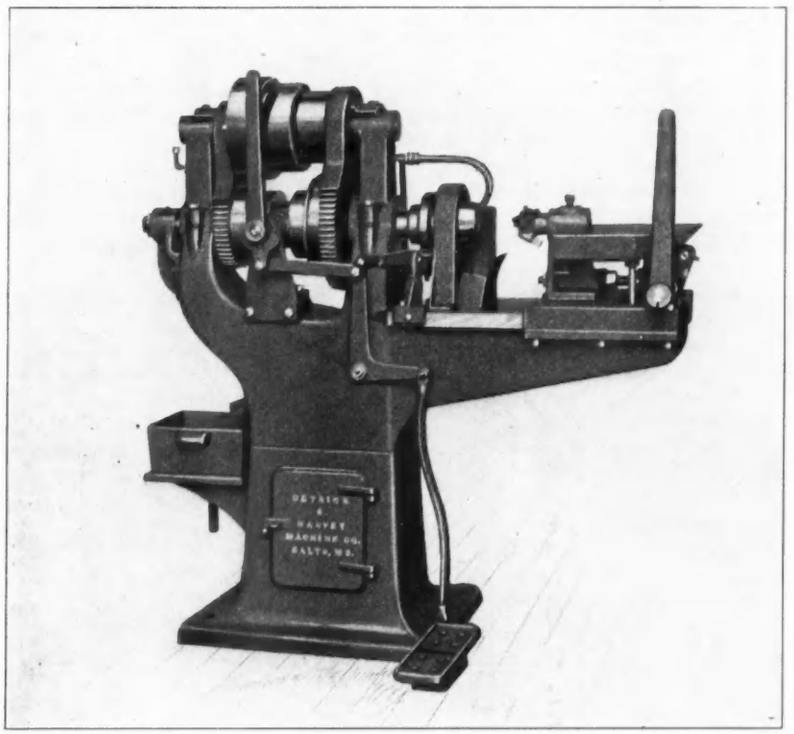


FIG. 1. NUT-FACING MACHINE.

start the nut. As the nut withdraws from the pintle, it is followed up by sliding the sleeve *c* outward on the spindle and presently drops off, when the operation of the treadle again reverses the machine for the next nut. The bush *d* will be seen to form a guide for the nut so that it may safely be entered on the pintle without stopping the machine. A globular-seated washer behind the nut insures square facing.

Labor Legislation in New Zealand.

United States Consul Frank Dillingham, sends from Auckland, New Zealand, some interesting facts concerning the labor laws of the colony. We reproduce a small portion of the report as a matter of information:

"The most important of these labor laws in its general significance is that dealing with compulsory arbitration in labor disputes. The 'industrial conciliation and arbitration act' of 1894, with its amending act of 1895, is supposed to have been enacted for the purpose of encouraging industrial association and to facilitate the settlement of trade difficulties, but it is very doubtful if it has succeeded in doing this.

"Under this act, any society may bring a disputed case before the Board of Conciliation appointed for that district, and if the board fails to effect a settlement, the dispute may be referred to the court of arbitration, whose award may be enforced in the same manner as an award of the Supreme Court. The amount, however, for which such an award may be enforced against an association is limited to $2,500 (£500).

"The manufacturing population in this colony differs somewhat from that in some of the Australasian colonies by its wide dispersion. Wellington, the capital, has heretofore been unable to draw to itself the industrial activity of the other provincial centers; Auckland, Christ Church and

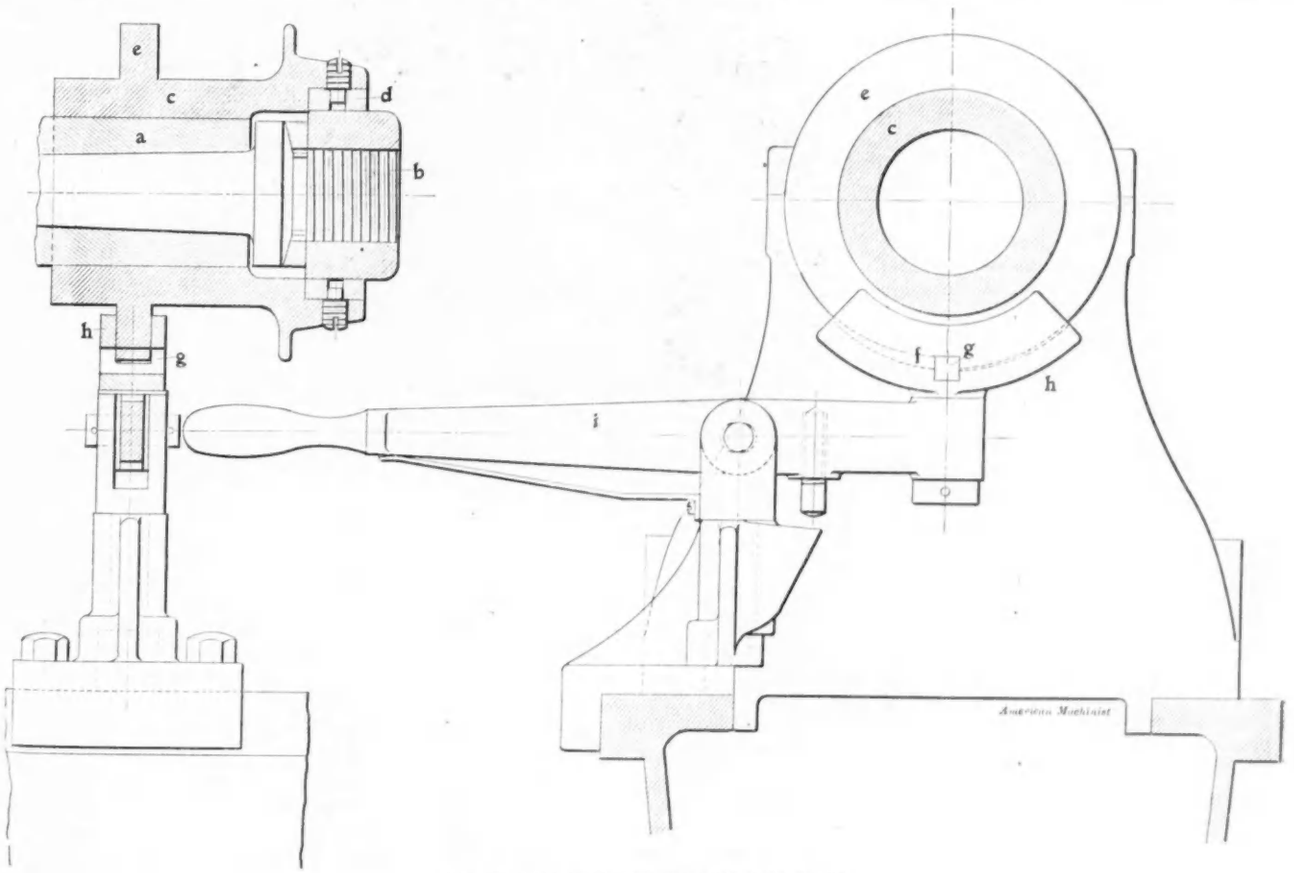


FIG. 2. OPERATING FEATURES OF NUT FACER.

Dunedin vie with it, not only in population, but in commerce. It is claimed by the friends of the compulsory-conciliation act that the general dispersion of industry in the colony requires both a system of supervision and legislative measures of a peculiar character, sufficiently elastic to comprehend many varieties of function, yet rigid enough to crush any apparent abuse.

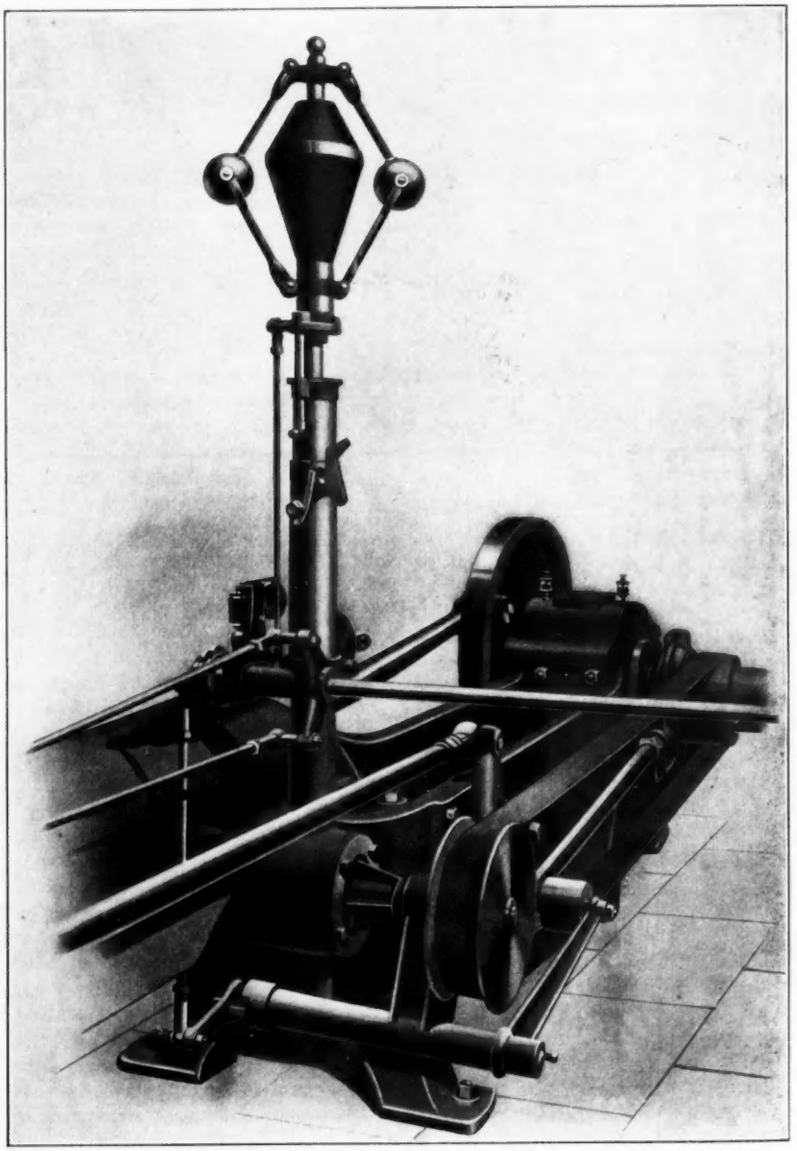
"For some time past the employers' associations and the industrial association in the south of New Zealand have united and tried to get the Auckland Employers' Association to join them in an effort to resort to the Court of Appeal, and, finally, to the Privy Council, to test the validity of the 'tyrannous'—as they call it—preference of trade-unionists to non-unionists in the labor market. An important decision was given at Wellington on May 10 last by the Court of Appeals, regarding the award of the Arbitration Court in labor disputes under the industrial conciliation and arbitration act. It has been the custom for the Arbitration Court to place a clause in the award compelling employers to give trade-unionists preference for employment in a particular industry. Recently, the master plumbers and gas fitters at Christ Church applied to the Supreme Court for a mandamus to prevent the Arbitration Court from giving preference for employment to members of the trades union, in the dispute then under review. Judge Denniston held that the court had a perfect right to give such an award if it thought fit, and dismissed the motion. This decision was appealed against, with the result that the full court has unanimously decided in favor of the judgment.

"In the course of his judgment, the Chief Justice stated that non-unionists were altogether outside the act. They had been excluded. A non-associated workman had no status under the statute. The statute must be obeyed, however contrary it might be to what was deemed natural justice. The status of individuals might be changed and the rights of persons affected, and there was no appeal to any other court in New Zealand. Then, the disputes must be in reference to 'industrial matters,' which were duly defined in the statutes. The definition of 'industrial matters' seemed to His Honor to include every kind of possible dispute that could arise between an employer and his workman. The act, in effect, abolished 'contract' and restored 'status.' The only way the act could be rendered inoperative was by workmen not associating or not joining any union, for, as had been said, the statute could not deal with unassociated workmen. No doubt the statute, by abolishing 'contract' and restoring 'status,' might be a reversal of a state of things that existed before our industrial era.

"That is to say, so long as some persons will form trade unions, the act will be operative, unless repealed by government, which is not likely as long as trade-unionists can make and unmake parliaments.

"Mr. Justice Williams said: 'The non-unionist had no legal right to demand employment. He could sell his labor at what price and on what terms he chose, provided he could find an employer able and willing to accept his terms; but he had no right to demand that there should be an employer able and willing to accept his terms.'

"In other words, it would appear that the non-unionist can sell his labor if he can get an employer to run the risk of encountering vexatious and expensive legal proceedings, instituted by some union for engaging him, instead of a unionist. For instance, if A, being a unionist, applies for work, and B, a non-unionist, applies, and the employer, knowing the non-unionist and believing him to be the better workman, engages him, then A could set the law in motion, make the preference to the non-unionist an 'industrial dispute,' and put the employer to the trouble and expense of trying to justify his employment of B instead of A. What employer will run that risk? He finds it less expensive to submit to the law and employ the less competent man, whom he does not want, than to fight it. In theory, he need only employ the unionist if he be equally capable; but, as the proving of the equal capability involves a lawsuit, the theory is impracticable."



A NEW ENGINE GOVERNOR WITH SAFETY STOPS.

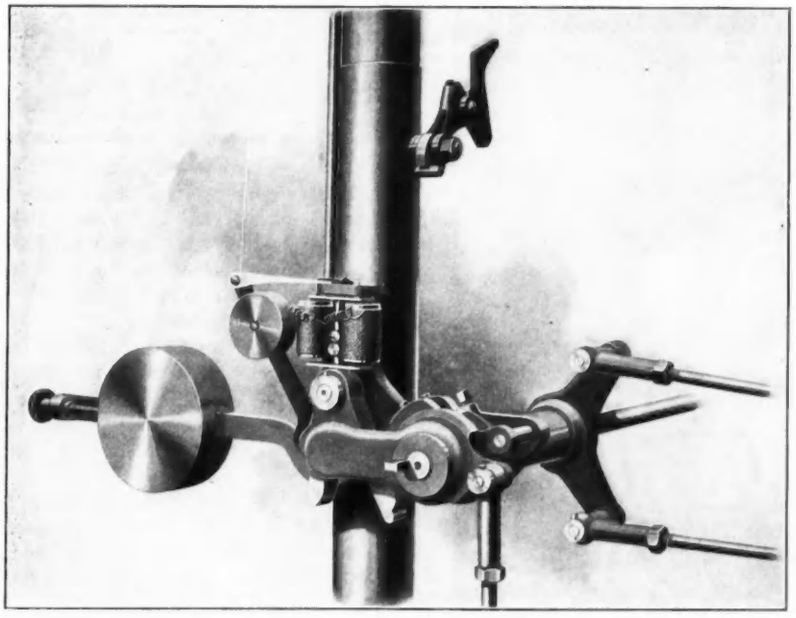
The Other Side of the Shield.

Everyone whose memory goes back twenty years must note a most significant change in the tone of the commercial press, and, indeed, the same change is to be observed in the daily paper. At that date it was not uncommon for homilies to be addressed by these papers to foreign governments and municipalities, on the error of their ways in preferring to supply their wants from native sources rather than to patronize English manufacturers, who could then fill most contracts better and

more cheaply than any of their competitors. To-day we still have homilies, but there is a change both in the style and in the name of the addressee. No mention is now made of the "divine principles of political economy," but our own imperial and municipal authorities are severely rated should they supply any of their needs from abroad, even though our own workshops may be so crowded that delivery is impossible within reasonable time; or if, as in some cases, the cost of the foreign-built article is substantially less. After all, there is a deal of human nature in man, and principles which twenty years ago, when we were able to easily undersell all competitors, seemed founded on rock, are now having doubts expressed as to their stability.—"Engineering."

New Safety Device of the Hewes & Phillips Corliss Engine Governor.

The accompanying illustrations show the safety features of the governor applied to the Hewes & Phillips Corliss engines, and



ENLARGED VIEW OF SAFETY DEVICES ON HEWES & PHILLIPS GOVERNOR.

which would appear to provide for almost any contingency. An increase of speed above the normal or the breakage of the governor belt is immediately followed by the stoppage of the engine, and, in addition, electric push-buttons or switches are located at convenient points about the works driven by the engine, by which the engine may be stopped from any department, should an accident or other occurrence happen there which would make such stoppage desirable.

Fig. 1 shows the bracket attached to the governor post with the rock shaft, lever arms and rods by which the cut-off cams are operated. At the left of the post will be seen a rod which descends from the governor, and by which the rock shaft is connected to the governor. This connection, however, is not direct. The horizontal weighted arm is connected positively with the rock shaft, the counterweight supplying the force by which the cut-off cams are moved toward the late cut-offs, while the adjustment of this counterweight on its arm serves to alter the speed. The weighted arm is lifted and the cut-off cams moved in the direction of early cut-offs by the pull of the governor rod; but this rod is connected directly to the swinging piece on which the electromagnet is mounted, while the latch, which is pivoted just below the electromagnet serves to make connection with the weighted arm. This latch acts in precisely the same way as the latches on the admission valves, and if it be opened in any manner, the counterweight will drop at once and carry the cut-off cams to the extreme position, where the usual safety toes come into action and prevent the steam valves from again opening. The various safety devices are made to act on this latch.

Above and to the right of the latch and mounted on the bracket boss are two disks carrying knock-off cams, both plainly seen. These disks and cams are similar to and act in essentially the same manner as those which release the latches on the steam valves. The one nearest the observer is connected, by the vertical rod shown, to a horizontal lever which carries at its end an idler pulley, which rides on the governor belt in the manner shown in Fig. 2. Should the governor belt slacken or run off, this pulley will drop, the rod will be raised, the knock-off cam will release the catch, the counterweight will drop, and the steam valves will go to the closed position and stay there, as already described. The idler pulley is made to ride upon the slack side of the belt instead of the driving side, as usual. Mr. Phillips considers that the most dangerous condition of all, and the one which is most likely to arise in connection with the governor belt, is the gradual slackening of the belt, due to the lacing becoming loose. Under this condition things continue to operate; but in the slackened condition of the belt, while the governor yet retains its normal speed and continues to operate the valves, the slippage of the belt causes the engine to run faster and faster. The driving side of the belt, however, remains taut, and if the safety pulley rides there it will not act to close the valves until the belt becomes so loose that disaster may, and probably will, have already happened. With the safety pulley on the slack side of the belt, however, it begins to drop as soon as the belt begins to loosen, and thus acts at once to stop the engine.

The knock-off cam farthest from the observer is fixed to a stationary disk, but is adjustable on the disk, being retained in position by the binding screw shown. After the engine is set up and belted, steam is turned on, and when the engine is driving its friction load only, the governor being in the highest position that it will ever occupy under normal conditions, the cam is adjusted so that it will just not trip the latch. The governor is, however, free to go higher, and should it ever do so under an excess of speed, the latch will strike the cam, be released by it, and the engine will stop.

The jointed lever attached to the upper end of the governor post takes the place of the usual safety collar or pin and enables the governor to act on the safety toes when it drops below the end of the normal working range. Its action is automatic, and it is always in the safety position, regardless of lack of attention by the operator. The governor thus acts to stop the engine, should it drop too low or rise too high.

Above and to the right of the counterweight is a small weight, which is held suspended by a catch. This catch is released whenever, by closing switches or push-buttons located at various places about the works, an electric circuit is completed which energizes the small electromagnet. The weight being released, it drops and opens the latch already described, whereby the counterweight falls as before and closes the steam valves.

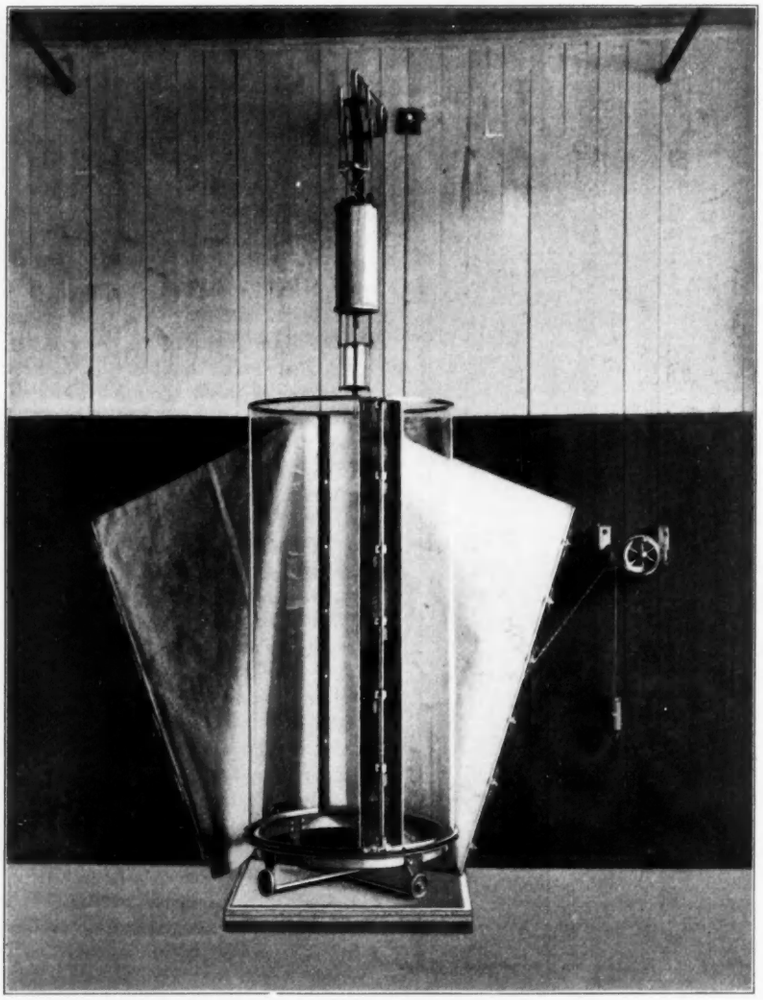
In connection with the summer school work of the Massachusetts Institute of Technology there was perfected, a few years ago, under Prof. Burton, a base measuring apparatus (used for measuring base lines in a geodetic or coast survey). This has lately been tested by the Coast and Geodetic Survey at Washington, with such results that it is about to be used in the important Lampasas Base in Texas. One part of the apparatus maintains a constant tension in the steel tape while in use. Another part determines electrically the temperature of the tape.

An Electric Light Blueprint Machine.

The accompanying illustration shows the latest evolution in the process of making blueprints—namely, a device which discards the use of sunlight for an electric arc lamp, with provisions for insuring exactly uniform exposure. The chief object of the machine is, of course, to make the printing independent of sunlight and the weather, although the uniformity of the prints and the extra good contact are additional advantages.

The illustration shows the machine to consist essentially of a cylinder of plate glass, which is made in halves longitudinally, and an electric arc lamp with means for lowering it down through the cylinder. The tracing and sensitized paper are wrapped around the outside of the cylinder and confined by stout canvas covers. The lamp is then released and descends through the cylinder at a speed which is regulated by a pendulum and escapement shown attached to the wall at the right—the escapement being driven by the lamp cord which wraps around a drum connected to the escapement wheel. The lamp goes down but once for an exposure, and on reaching the bottom is quickly withdrawn by winding up the cable, or, in case the tracing is a small one, the lamp is allowed to go only to, or, slightly beyond, the lower edge of the tracing. The speed of the lamp's movement, and hence the time of the exposure, is adjusted to suit different brands of paper by properly setting the pendulum bob on its rod and thus altering the length of the pendulum.

The upright at one of the joints in the glass carries some horizontal flat steel springs to the ends of which vertical strips of wood are attached which act as clamps to hold the first edge of the tracing and sensitized paper. The sheets of canvas are attached to the same upright under the springs. To the free edges of the canvas are attached, by tension springs, a number of hooks which hook over a metal rod on the upright at the opposite joint in the glass—shown on the front side in this picture. The spring hooks insure an even pressure everywhere and give the best possible conditions for securing perfect contact. In fact tracings that have been folded and badly creased can, with a little care, be made to come down to excellent contact.



ELECTRIC LIGHT BLUEPRINTING MACHINE.

To save the labor of walking around the machine, it is placed on rollers so that it may be easily revolved. A cast-iron floor plate is provided, a spindle in the center of which keeps the machine in position on the base.

The machine is made in various sizes accommodating tracings from 30 by 42 inches in the smallest to 42 by 84 inches in the largest. The size shown takes 42 by 60-inch tracings. Each tracing occupies but one-half of the cylinder, so that two prints may be made at once.

Attempts have previously been made to print by electric lights, but as the previous plans have been with flat surfaces, groups of lights have been necessary, and this has resulted in spots or uneven printing. It is of course obvious that by the present plan the strength of the light and consequently the printing are precisely equal on all parts of the tracing and the light being close to the surface its action is rapid, two prints 42x60 inches being made in from 2½ to 3 minutes.

The lamps are adjusted to any available current, and besides the regular sizes the machines can be made of any desired size.

The machine is made by the Pittsburgh Blue Print Company, of 1505 Park building, Pittsburgh, Pa.

The Use of Arithmetical Tables.

BY BELL CRANK.

Observe any of the best-known mechanics' pocket reference books after it has been used a few years, and there is always indisputable evidence that the arithmetical tables are used oftener than any other part of the contents. Though it may be well preserved in all other parts, the tables are worn to a useless condition. For drawing-room and office use, it would be more economical and convenient to have all the most used tables in a separate volume.

Not all who refer to tables know how to get the most out of them, and especially is this true of those who are to a large extent self-taught and are just beginning the use of them. To help such persons is my purpose in this article, and all others need go no farther, because they will find nothing new here. Tables of areas of circles and of squares, cubes, square roots and cube roots of numbers only will be considered.

It is often required to find areas of circles of a fractional diameter, and some reference books have very incomplete tables of such, but all that is really needed for the purpose is a table of areas of circles whose diameters are whole numbers. The result is found by putting the diameter in the form of a decimal. For example, take .97 inch diameter; what is the area? The area of 97. is 7389. Point off twice as many decimal places as are in the diameter, and we have .7389 the area. Or take diameter .01 inch. The area of 1 is .7854; add four decimals and we have .00007854 inch. Or again, take diameter

34.7 inches. The area of 347 is 94,569, and pointing off two decimals gives 945.69 for the area belonging to diameter 34.7.

The reason for doubling the number of decimal places of the diameter comes from the fact that to find the area of a circle, the diameter is first multiplied by itself, or squared; hence there must be twice as many decimal places in the product, to conform to the rule for multiplication of decimal numbers.

Sometimes it is required to find the area of a circle larger than is in the table. The range of the table may be doubled by taking the area for half of the desired diameter and multiplying it by 4. For example: Required the area for 996 diameter; half of this is 498, the area of which is 194,782, and this multiplied by 4 = 779,128, the area required. There are doubtless other ways that such a table may be used to advantage which some of your readers might tell us about.

Referring to the table of squares, cubes and roots of numbers, which usually gives the squares and cubes of whole numbers only, it is sometimes required to know the square or cube of a fractional number. To find the square of .9, take the square of 9 and point off two decimal places, giving .81; or the cube, and point off three, giving .729, as all cubed numbers must have three times and all squared numbers two times as many decimal places as there are in the number to be cubed or squared. Finding the square or cube of a whole number and fraction is done the same way. To find the square of 7¼, take the square of 725 = 525,625, and pointing off four decimals gives 52.5625; or the cube of 7¼ = 381.078125.

It is often required to find the square or cube root of numbers larger than are given directly in the table. Suppose the square root of 12,850 is desired. Look in the column of squares for the nearest number, and it will be found that the square of 113, which is 12,769, is the nearest, but is too small, and the square root will be a fraction more than 113. To get one decimal place in the root will require two in the number; hence it would make a total of seven figures. Look down the column of squares to where there are seven figures and find the nearest to 12,850 (considering the two right-hand figures out of the seven as decimals), and the nearest number is 12,859.56, and the root is 113.4. With the usual table going up to 1,600 this method is available only for finding the square root with one decimal, of numbers between 1,600 and 25,600.

By the use of the column of cubes of numbers in the same manner, the cube root with two decimal places may be found for numbers from 1,600 to 4,088; or the root with one decimal place for numbers from 4 096 up to 4,088,324. For example: Find the cube root of 3,504; the nearest number in the column of cubes is 3,375, the cube of 15. As there are to be two decimals in the cube root there must be three times this = 6 added to the number of figures which makes 10. Looking in the column of cubes we find 3,504.881359 (using the six right-hand figures as decimals), and the root is 15.19.

Always be careful to keep in mind that in finding square roots there must be twice as many decimal places in the number as in the root, and in finding cube roots there must be three times the decimal places of the root.

There are several other ways of using the table, but it is not necessary to explain them here, as these methods are given with nearly all such tables.

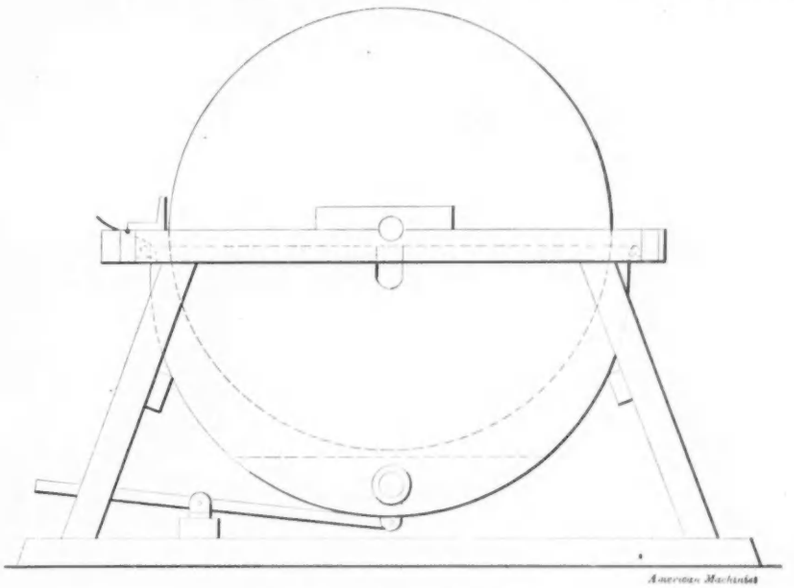
Letters from Practical Men

A Grindstone Convenience.

Editor American Machinist:

While most shops are nowadays provided with special tool grinders and sharpeners, the old grindstone still seems to have a place of its own among them, and I have often observed that most machinists prefer the grindstone when it is kept in good shape and well supplied with water. The chips seem to curl up with less friction and consequent heat when the tool has been ground on a grindstone. The chief objections to grindstones are that they do not hold their form any great length of time, and that the means usually employed to keep them well supplied with water are usually so unsatisfactory. If the stone is kept submerged in water when not running, soft spots will result, and these will wear much faster than the rest of the stone. The second objection thus becomes the cause of the first. Probably the best way to dress a grindstone is with the B. & S. roller-truing device, although it is more frequently done with a piece of gas pipe.

The accompanying sketch shows how we arranged a water supply for our grindstone, the essential feature being to keep a large supply of water for the wheel, to keep the wheel dry when not in use, and to keep the floor and surroundings clean and dry. Twice a week was about as often as it was necessary to supply water to the trough. The wheel in this case was mounted on a wooden frame and the trough for the water was made of No. 20 galvanized iron; the trough was made high enough to enter the top of the frame which served as a guide, the trough fitting loosely, thus returning all the water to the trough again. When down, the trough held about three pails of water below the bottom of the stone. The treadle, made of a piece of pine 1x5 inches, was connected to the trough by a couple of kettle ears and fulcrumed about the center of its length to the floor. The weight of the water held the trough down, and a pressure of the foot quickly brought the water in contact with the stone. A couple of cleats screwed to the legs of the frame supported the trough when in its lower position; a large wing screw on the side gave access to the bottom of trough to empty and clean it, or to fish out some tool, and the whole trough could easily be removed entirely if necessary. Obviously it might be made of any suitable material that could be made water-tight, a wooden box often answering every requirement.



A GRINDSTONE CONVENIENCE.

GEO. J. MEYER.

Patching a Large Hydraulic Press Table.

BY A. F. HORTON.

One morning not long ago it became my duty to answer a call at the telephone, where I received the following message: "We have a large hydraulic press with a steam table. The table has a break in it that leaks steam. Can you repair it?"

The press being in an adjoining town, I had not the opportunity to view the job while they awaited an answer at the telephone. I answered them, saying I thought I could repair the table, and they advised me to begin at once.

I found the press to be a very large one, weighing about 50 tons and used for pressing sheets of rubber; the table being made in two parts, clamped together with bolts so as to be tight at a steam pressure of 30 pounds. The dimensions of the table were: 35 feet long, 5 feet wide, each half weighing 5 tons. The break was 34 inches, and about 8 feet from the end of the table. Great care had to be exercised in taking the table apart, for fear of breaking. I was informed after I had the job under way that experts had examined the press and said the table could not be repaired, and that a new one must be made, which would mean an outlay of $5,000 and a wait of four months, just in their busy season. Having in my employ a mechanic whom you often hear termed a "jack of all trades," I decided to give him the job, and told him what I wished him to do, stating just what they required of him, and told him to pick out his tools and be ready to leave on the first train in the morning of the following day. Upon his arrival at the factory, he was shown the press and informed what was required of him. I learned afterwards that he was expected to give up the job and return home, but instead he made ready to do the work. Having a helper with him, they began removing the bolts that clamped the two halves of the table together. These bolts were 1 inch in diameter and numbered 156. Having the bolts removed, the work of separating the table began in the following manner. The top of the table being shown in Fig. 2 was the part with the break in it and the one that was to be removed from under the press. Having the bolts out, twelve holes were tapped with a 1¼-inch tap, four on each side and two at the ends *I*, Fig. 2. Twelve stud-bolts were made as shown in Fig. 4, the large end being made to screw into the holes just tapped 1¼ inches. The small end was ⅞ inch and threaded for a nut. This end went through the corresponding holes in the upper table, shown at *J*, Fig. 1, and a nut placed in position. The upper half of lower table being thus bolted to the upper table, which was the working table, and the press being set in motion, the upper half of the lower table (which was the broken part) separated from the lower half and hung suspended from the upper table. Blocks were then placed in position, and the same hight as the horses that had been provided to rest the table on, and the press was again set in motion and the table lowered on to rolls. The bolts then being removed, the table was rolled on to the horses, ready to receive the patches.

After the table had been successfully removed, I was informed that the operation of removing the table was the argument upon which the experts who examined the press had based their opinion that the work could not be done successfully. The operation of fitting the patches began by chipping through the center rib, shown at *H*, Fig. 2, to allow the patch to fit close against the table. The pin-holes *B*, Fig. 2, were then drilled and two pins turned to a driving fit and driven into the holes. The object of drilling these holes in the table on an angle was to prevent the steam working around the break to the top. By drilling the holes in that position, after the patch had been fitted, the pins were the shape shown in Fig. 5. Having fitted the patch C_2, Fig. 2, this being ⅜ inch thick, 2½ inches wide and having twenty ½-inch holes for the screw *D*, Fig. 2, holes to correspond were then drilled and tapped into the table, and with the packing of rubber *G*, Fig. 2, the patch was bolted on. After this operation had been completed, the rib that had been severed to allow the patch to enter was drilled for a ⅝-inch bolt and a strap made and bolted on to again connect the rib.

Having finished the work of placing the lower patch it was now time to look to the top. This part of the work was the most essential part of the job for there could be no seam or imperfection whatever on the surface of the table, because it would leave a mark on the rubber. The operation of fitting the upper patch was commenced by chipping a slot 39 inches long.

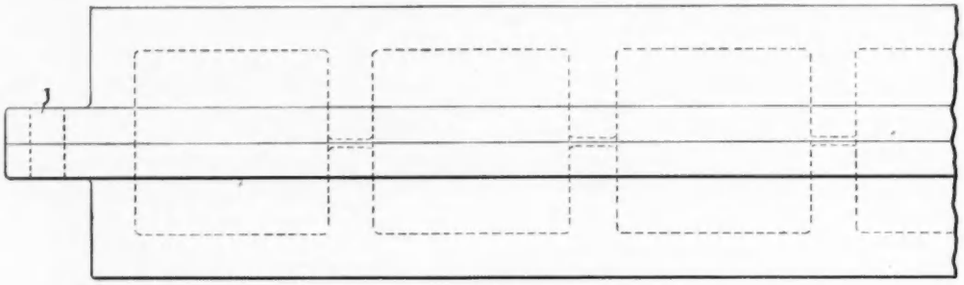


Fig. 1

Fig. 5

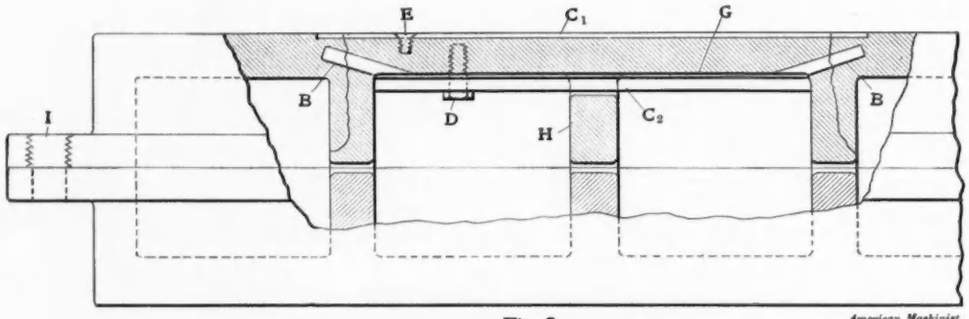


Fig. 2

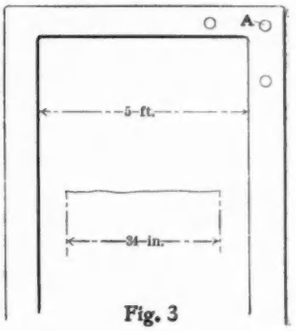


Fig. 3

SHOWING THE CRACK IN AND METHOD OF REPAIRING A LARGE HYDRAULIC-PRESS TABLE.

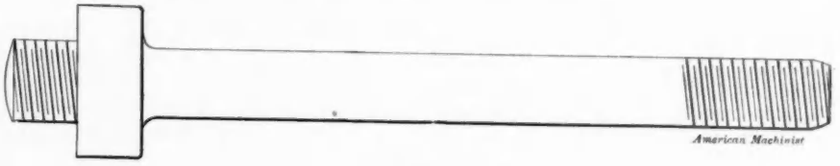


Fig. 4

4 inches wide and 15-64 inch deep, the patch being shown at C_1, Fig. 2. It will readily be seen that the chipping of this slot required a great amount of patience, hard labor and skill. After the slot had been roughed out with a large chisel and sledge, a small chisel and hammer were used to trim it out to its proper dimensions. The slot being finished the patch was then taken in hand to be fitted, which was done on a shaper, it being planed a fraction of an inch larger than the slot so it could be forced in to make a close joint. It was then put under the drill and 32 ½-inch holes were drilled and the tops countersunk to a very sharp angle, E, Fig. 2. The patch was now ready for bolting to place.

The question of packing now arose. It has been proved that a rubber packing will expand and contract enough when it is placed between two surfaces to cause a slight vibration to the lighter part. The rubber scheme being therefore abandoned, a substance had to be found that would answer. A composition was then used which was composed of red lead and varnish mixed to a medium thickness, a layer was placed in the slot and the patch placed into position and bolted down. The heads of the screws were then cut off and the work of riveting began, after which the edges of the patch were peened to make sure there would be no imperfections between the patch and table. The patch was then filed smooth with the table.

The table was then placed in its original position. After it had been connected, a steam pressure of 30 pounds was let into the table with no sign of a leak. Not being satisfied with that test, a sheet of rubber was pressed and no sign of an imperfection was visible upon it. The superintendent being satisfied the job was a success sent for the chief engineer, who had always maintained that the table could not be repaired and had even gone so far as to make fun of the man when he commenced the job and several times while it was under way. The superintedent asked him what he thought of the job, but he would not say until he had seen a sheet of rubber pressed, and then he replied, "It is the finest job I ever saw." The officials of the corporation gave the man all the credit that was due him. The press is in use at this writing and doing its work as well as it did before the table was broken.

Providence, R. I.

Some Curious Drill-Press Speeds.

Editor American Machinist:

While it is my belief that, as a rule, very few machinists apply the principles of Christian science to their work, I recently found an instance in which that had evidently been done to perfection.

A certain back-geared drill press in our shop, built by a manufacturer of drill-press fame, runs eight revolutions per minute faster at the highest speed *with* the back gear than it does at the slowest *without*. Just think of the large number of times someone went to the trouble of throwing in the back gear for the purpose of running "one speed slower," and, though actually higher, was satisfied that speed was easier on the drill. It cannot be doubted that many times this operation was reversed to obtain the next higher speed, when, of course, the opposite was the result.

Now, I don't know it all, by a long ways, and perhaps the maker had some object in view—like the Irishman, of whom it is reported that, when he got the saddle wrong end to, in saddling a horse for the first time, and someone pointed out the apparent mistake, he said, indignantly, "How do you know which way I am going to ride?"

I once before ran across a lathe in which there were but one or two revolutions per minute difference between these two speeds; but when I met with a case of that kind I always (perhaps in ignorance) considered it a mistake in design.

Will someone who knows more please give more light on this subject?

CORNEIL RIDDERHOF.

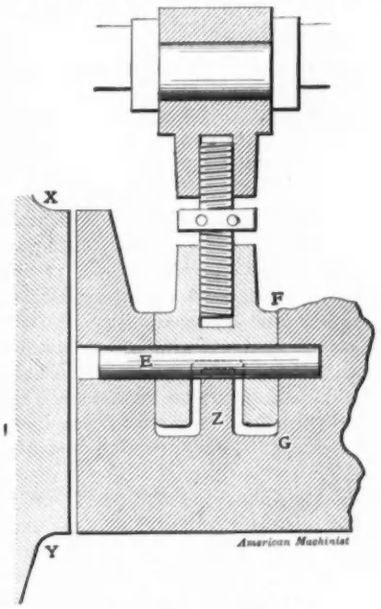
Grand Rapids, Mich.

A Large Perforating Press.

Editor American Machinist:

Permit me to call attention to some features of the large perforating press illustrated in your No. 43.

Fig. 3, page 1024, shows a bearing on



PRESS BEARINGS.

right and left of slide something like 36 inches wide while the bearings on front and back are only about 3 inches wide. Evidently there is either too much surface on the sides or too little on front and back.

Your reference to the front and rear bearings being a considerable distance apart in view of the contention of some press builders that this is an advantage is certainly misleading. If a great distance between the bearing of the slide is an advantage, why does the slide not keep in alinement from right to left without double pitmans?

The feature of cutting away the pitmans at $G\,G$ strengthens them for downward stroke, but weakens then for the upward or return stroke. The accompanying sketch shows a pitman cut away in the center with a support, Z, for the center of the bearing. This feature was embodied in a pr ss built by the same company and illustrated in your paper December 31, 1891.

Another feature of sliding surfaces which Professor Sweet has called attention to several times, is that they should be of nearly equal length and slide past each other about the same amount at each end. Applying this to press slide bearings, they should be even at X and Y when the stroke is midway and the adjustment half out. From the half-tone it would seem this feature had not been carefully carried out in the press illustrated.

JOHN D. RIGGS.

Pittsburg, Pa.

Productive and Non-Productive Labor.

Editor American Machinist:

We read with interest a recent protest in your columns against the use of the terms "productive" and "non-productive" labor. I suppose none of us differ as to what is meant by the class of labor which is variously called non-productive, indirect and by half a dozen other terms. At the same time, it is as you say a very incorrect and sometimes a misleading term.

We speak in our factory of "distributed" and "non-distributed" labor, the former being, of course, labor which is directly charged in the cost of some particular job and the latter all labor which cannot be definitely located on any one order. How do you like these terms?

S. F. BAGG,

Secretary Watertown Engine Company.

Watertown, N. Y.

Substitute for Benzine.

Editor American Machinist:

In your issue No. 16 you mention an inquiry from a correspondent for a substitute for benzine for cleaning bearings, shafting and machinery at work where insurance policies or leases prohibit the use of the former inflammable substance. Hot soda water will fill the bill. Use just enough soda to leave the work bright without showing the soda on drying. Apply with a toy broom or a swab. Keep as near the boiling point as possible while applying, so it will dry quickly, and the result will be excellent. L. O. DANSE.

Detroit.

Punching Cast Iron.

Editor American Machinist:

In reply to the question of C. W. in No. 47, "Did any reader ever hear of punching cast iron?" I would inform him that I have not only heard of the punching, but I have seen the iron that has been punched with ½-inch holes, the thickness being ¼ inch, the punching being done with an ordinary punch.

But as all iron is not alike, it would be very hard to prophesy whether it would work in that case. FOUNDRY FOREMAN.

Personal.

E. C. Clark, for the past six years foreman machinist with Park Davis & Co., Detroit, Mich., has been appointed mechanical superintendent for that firm.

Obituary.

Isaac Stanton, an old-time builder of steam engines, died at Newburg, N. Y., December 9, eighty-seven years old. At the beginning of the civil war the firm of Stanton & Matthews were contractors for engines and boilers for government vessels, and they were compelled to make an assignment while building the "Marblehead," on account of the great advance in prices of materials.

The Remington Automobile and Motor Company, of Ilion, N. Y., send us a photograph of one of their internal-combustion motor-driven carriages plowing its way *through* one of the worst roads it has ever been our ill fortune to gaze upon, and they state that their machines are tested upon and expected to run *in* such roads, their idea being that an automobile should be made to run anywhere that a horse-drawn vehicle may go.

T. C. Flinn, superintendent of the Kennedy Valve Manufacturing Company, of Coxsackie, N. Y., writes that he is "rearranging his library of catalogs, and would like to receive the latest catalogs of makers of tools, materials and appliances pertaining to the manufacture of brass and iron goods."

We have to do with the good work that is done in machinery lines, and with little else. Yet good work is always respected, and the doers of good work have a regard for each other. Eugene Field did some dainty bits of work that have hardly been surpassed. He touched the hearts, brought tears to the eyes and quickened the kindly and helpful impulses. He should have a fitting monument. Subscribers of $1, or over, to the Eugene Field Monument Souvenir Fund receive a copy of "Field Flowers," which contains a number of his pieces, elaborately illustrated by the voluntary work of appreciative contemporary artists. Send to A. L. Swift, secretary, 180 Monroe street, Chicago.

Legal Notes.

BY WM. MARSTON SEABURY.

EVIDENCE OF EMPLOYER'S INSURANCE OF LIABILITY NOT ADMITTED ON GROUND OF RELEVANCY TO HIS NEGLIGENCE.

W. L. Barrett brought suit against the Bonhan Oil & Cotton Company to recover damages for personal injuries. While he was working for the company as a day laborer one of Barrett's fingers became caught between two cog wheels and was cut off. The plaintiff alleged that he had been ordered to work in a dangerous place without proper warning, the defendant knowing of his ignorance and inexperience; that the place was insufficiently lighted and that the cog wheels should have been covered.

The plaintiff endeavored to show at the trial that the defendant was protected, if damages should be awarded against it, by a policy of accident insurance which it carried, and plaintiff contended that this fact bore upon the question, whether or not defendant had used due care to prevent the employees from being injured. The trial court excluded the evidence, and the judgment was rendered for the defendant, upon appeal from which the Court of Civil Appeals of Texas held that the evidence was properly excluded. (57 S. W. R. 602.)

THE MASSACHUSETTS RULE AS TO "SATISFACTION," WHEN MADE A CONDITION TO THE ACCEPTANCE OF WORK.

The case of Williams Manufacturing Company against Standard Brass Company, decided some time since by the Supreme Judicial Court of Massachusetts, presents an interesting point for discussion. The Williams Manufacturing Company contracted with the Standard Brass Company to construct an equipment for melting brass, and "to place the above named outfit in operation for sixty days' trial for the approval of the second party (the Standard Brass Company), and if the results obtained after the trial are in accordance with the specifications above, and satisfactory to the second party, the second party further agrees to pay for the above named equipment the sum of $550."

The equipment was completed, and the Standard Brass Company commenced to make the sixty days' trial; but it stopped the trial before the sixty days had elapsed and refused to accept the equipment, upon the ground that it was not "satisfied" within the meaning of the contract.

The Williams Company brought suit against the Standard Brass Company in the Superior Court of Middlesex County, Massachusetts, upon the contract, and received a judgment in its favor. The defendant appealed successfully to the Supreme Judicial Court. In the opinion of the court Mr. Justice Holmes said: "Upon the findings of the jury, it must be taken that the work was done in accordance with the specifications of the contract and in such a way as to be satisfactory to a reasonable man. . . . The questions raised by the exceptions are whether the defendant's liability was conditional upon actual satisfaction, even if the dissatisfaction was unreasonable, so long as it really was felt . . . . We are of the opinion also, with some slight hesitation on my part, that the defendant's liability was conditioned as above suggested, and that *bona-fide*, even if unreasonable, dissatisfaction of the defendant is an answer to the plaintiff's claim." (53 N. E. 862.)

"SCOPE OF EMPLOYMENT" EXCEEDED IN PUTTING ON A BELT.

Another "legal curiosity" such as was commented upon in a recent editorial has been decided, and this time by the Supreme Court of New Hampshire. Amedee Parent was employed by the Nashua Manufacturing Company as a weaver. He had nothing to do with the belts or machinery, which were under the care of a loom fixer. Once the loom fixer while adjusting a belt beckoned Parent to come to help him, which Parent did. While the loom fixer held the belt in place upon the upper pulley Parent placed his foot against it, and attempted to kick or push it upon the lower pulley. Parent was caught by the belt and carried over the shafting, receiving severe injuries, upon which he brought suit against his employers.

There was no evidence as to the cause of the belt catching the plaintiff, but he offerred testimony of expert loom fixers to show that the drawing up of the belt by which he was caught must have been caused by contact with another belt. This evidence was excluded and a verdict ordered for the defendants. The plaintiff appealed. In overruling the plaintiff's exceptions, the Supreme Court, Mr. Justice Parsons writing the opinion, said: "As there was no defect or fault in the machinery or belting, the plaintiff's injury must be attributed to his own carelessness or to the risk naturally attendant upon the work which he undertook. This work was beyond the scope of the duty which he was employed to perform, and there is no evidence that the loom fixer had any authority to permit or require him to perform it. Voluntarily engaging in work for which he was not hired, without request from the master, he assumed the risk attendant thereon. The evidence of the loom fixers as to their opinion of the cause of the accident was properly excluded. The facts upon which the opinions were based not having been proved, the opinions, if admissible at all, were immaterial."

This case presents another strong illustration of the willing employee who is made to bear without compensation the burden of his injuries sustained while endeavoring to advance his employers' interests. 47 Atl. R. 261.